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Technical Education.

The address by Professor Alderson, from which we print extended extracts in another column, is the most comprehensive statement that we have even seen of the extent, work and scope of the German schools of technology, and as we are convinced that this is an important subject to this country, we are glad to find a place for these extracts.

There is undoubtedly a good deal of confusion in this country regarding the meaning of the term "school of technology." By many, a school of technology and a school of mechanical enginering are considered to be identical. For this our schools are themselves to blame, several of them which are primarily or wholly schools of engineering, going under the official name of an Institute of Technology. The Century Dictionary defines the word "technology" thus: "That branch of knowledge which deals with various industrial arts; the science or systematic knowledge of the industrial arts, as spinning, metal working or brewing."

It will be seen that, except in so far as their work relates to the construction of machinery, a school of mechanical engineering is not properly a school of technology at all, while a school of architecture, which treats of design only, is in no sense such a school. On the contrary, the school of Crefeld, Germany, for teaching weaving and dyeing, and the Lowell Textile School are properly schools of technology.

Our readers are well aware of our opinion of the shortcomings of our engineering schools, but we believe the same shortcomings are universal in similar schools of other countries, and it is at least probable that the instruction given in the best American engineering schools is the equal of that given anywhere in the world, and in the knowledge of this fact, in the idea that our enginering schools are really schools of technology, and in ignorance of the enormously larger scope of schools of technology than that of any school which we possess, the public has, we believe, come to consider that our position in this matter is far in advance of what the facts justify. The fact is that American educational enterprise has run to the establishment of engineering schools, to the serious neglect of schools of technology. We believe that of engineering schools, properly so called and on existing lines, the country has at present enough, but that of schools of technology proper it has very far from enough. It is in fact a matter for grave doubt if much better results would not have been obtained if a large proportion of our engineering schools had been schools of technology properly so called. These things run in grooves. The various States, in organizing their universities on the basis of the Morril land grant act, have done little more than copy one another in the type of school to be organized, and we thus have a substantial duplication of educational facilities in numerous States. It is greatly to be deplored that this should have been so, and that the various States should not have organized schools to teach their own characteristic industries. One exception to the general rule is so conspicuous and so meritorious that it deserves to be mentioned. We refer to the Michigan Mining School, at Houghton, Mich.—an institution established by the State to further the great industry of its northern peninsula, and located in the center of that industry. No more ideal location for such a school could be found, and no more appropriate act in the furtherance of education was ever taken by any government.

The schools endowed by private funds have copied one another with equal slavishness. It is no easy matter to organize a school on new and untried lines and to teach subjects which have not before been reduced to the systematic analysis and discussion necessary for presentation in the school room, and not the least of the difficulties connected with such an enterprise is the finding of competent and suitable men to act as teachers. It is far easier to do again that for which numerous precedents exist and for which a trained and proven body of teachers is available.

The experience of Germany demonstrates the practicability and usefulness of schools of technology. A beginning has been made here on similar lines of development, but it is a beginning only. It is time, and more than time that the public should be awakened to the situation and that some of the bountiful stream of philanthropy for which this country is so conspicuous should be turned in this direction.

Rights of Shop Inventors in Germany.

In our present issue Mr. Tecumseh Swift discusses "The Rights of Shop Inventors," and in connection with his subject the following report of a case in Germany, furnished by Consul General Richard Guenther, at Frankfort, will be read with interest:

"It appears that a foreman in the employ of a certain establishment invented a substance which his employer used in finishing "rustling" velvet. The use of this substance was considered a trade or business secret of the firm. The foreman, however, imparted the composition to others, and the firm had him tried under the law of May 27, 1898, entitled 'An act for the suppression of base competition' *(Gesetz zur Bekaempfung des unlauteren Wettbetriebs)*. The foreman was found guilty in the lower court.

"The case was appealed to the Federal court and the defense made the point that the foreman had only imparted his own invention to others; that the same was his intellectual property. The Federal court dismissed the appeal on the following grounds:

"The foreman was employed as such by

the firm, and therefore it was his duty to try experiments by which the methods of work could be improved.

"His achievement in inventing the substance was therefore only a part of the services which he owed to his employers. The invention belonged to his employers, and therefore the action of the foreman in imparting the secret to outsiders was in violation of the law referred to. Only an employee is intrusted with experiments which may lead to such inventions. A stranger, whose labor does not belong to the establishment, is excluded from such experiments. The foreman was admitted to the experiments only on account of his employment by the firm, and it followed that the invention in question was made by him in consequence of his employment by the firm, for which he was paid."

Machine Tools Lost at Sea.

All hope of ever again hearing of the French steamer "Pauillac," which sailed from this port early in February, has practically been abandoned, and it is believed that the large cargo of valuable machine tools which she carried, and which were intended for exhibition at Paris, is at the bottom of the sea. We understand that a portion of the exhibit of the Brown & Sharpe Manufacturing Company, all of the exhibit of F. E. Reed, and many tools belonging to Western builders were on the missing vessel, and, of course, must be replaced. It is expected this can be done in time to avoid material interference with the exhibits as originally planned.

The "Pauillac" was built in Liverpool in 1891, and was christened the "Sedgemore." She was 406 feet long, and had a gross tonnage of 4,332.

Foreign Trade Notes.

Vice-Consul Monaghan has written from Chemnitz, Germany, to the Department of State as follows: "The following figures are very interesting and go to show the progress Germany is making in the markets of the world, especially in machinery. In 1890 she exported 88,295 tons, worth $16,065,000. In 1898 the export went up to 191,020 tons, worth $35,224,000. This is an increase of 120 per cent. This increase would have been much greater, it is claimed, had not the home demand assumed such gigantic proportions as to prevent German manufacturers giving close attention to the outside world. The country that played the most important part in this increase is Russia. Switzerland came second, then England, Denmark, Roumania, Italy, Holland, Sweden, Norway, and last of all the United States. The importation of machinery into Germany increased from 57,300 tons in 1890 (worth $10,472,000) to 83,760 tons in 1898 (worth $13,328,000). This increase is due mostly to the importation of American machines."

In regard to the export of machines to Russia, Vice-Consul-General Hanauer, writing from Frankfort, gives details as follows: "In the eleven months ending November 30, 1899, German locomotives and locomobiles shipped to Russia amounted to 11,000,000, against 5,900,000 pounds for the same period of the previous year. The shipments in cast-iron machines gained 28,000,000 pounds, and those of wrought iron 2,000,000 pounds during eleven months, as compared with the same period of 1898. The gain in money value of these three lines is estimated to be about $2,600,000. Sewing machines also increased."

According to a United States consular report, 364 new concerns were incorporated in Germany in 1899, with a nominal capital aggregating $129,620,000. This is the largest number and the largest nominal capitalization since the year of 1872, when 479 companies were incorporated, with a nominal capital of $351,833,000. Among the industries represented in the 1899 incorporations machinery is by far the most prominent, $26,000,000 of capital having gone into that line. The distribution of capital among other leading trades was as follows: Mining and smelting, $5,600,000; quarrying, $6,000,000; chemistry, $3,600,000; electricity, $8,200,000; textile industry, $4,400,000; breweries, $6,200,000; building trade, $9,000,000; banking, $6,900,000; railroads, $17,000,000; navigation, $15,700,000.

TENDENCY OF THE EUROPEAN COAL FAMINE TO INCREASE AMERICAN EXPORTS.

Pig iron resembles gold in the way its movement across the Atlantic in one direction or the other oscillates on the balance of values. In 1895, when foreign exchange was high, the shipments of gold to Europe reduced the surplus in the United States national treasury to an alarmingly low ebb. Later, when increased foreign sales of American merchandise gave a balance in our favor, gold came this way. Not many years ago we were importing pig iron from England. About the year 1897 the prices here and on the other side of the Atlantic assumed such a relation that we began to send some of it over there for a change, and before long we were shipping large quantities. When the business revival in the United States sent up prices once more there came a time when the current almost turned back again, and if we did not actually import iron from Great Britain, inquiries were made with that end in view. But the high prices abroad as well as here checked that tendency, and subsequently the domestic and foreign markets have remained almost in equilibrium, with prices about the same and no pronounced movement in either direction. Under these conditions any circumstance which will give either market a little boost must have a spectacular effect upon the direction of international trade. And this is not a matter of pig iron only, but of finished iron products, such as machinery. It is not dependent upon price merely, but upon delivery. Anything that hampers European manufacture either in point of cost or celerity of execution is of importance to-day.

For this reason a peculiar significance attaches to the present coal famine in Europe. The scarcity of coal there is in itself a matter of considerable moment, and is engrossing the attention of American consuls in their reports sent in from different Continental points. Many industries of Saxony and Bohemia, especially glass factories, have been forced, as a result of the strikes in the mines, to curtail their operations or shut down entirely. Even schools have closed for want of coal. Consul Hossfeld, at Trieste, believes that shipments of American coal to Europe are practicable. An import firm at Copenhagen is said to have written to an engineering firm at 39 Cortlandt street, New York, that iron and steel and leading engineering works are being delayed in filling their orders by lack of fuel, and that considerable business is likely to be sent to the United States in consequence. For that cause quotations are even now being asked. We cannot, of course, overlook the approach of the warm weather, which may relieve this over-demand for coal.

Mr. Archer Brown, of the well-known pig-iron firm of Rogers, Brown & Co., was seen by a representative of the "American Machinist." Mr. Brown stated that iron is being exported to Europe at the present time. For instance, the firm had that day booked an order for 1,000 tons to go to Italy. English and American prices, he said, are about on a par. The former are now advancing, an increase of 6 shillings ($1.50) per ton having been made in the past ten days. Mr. Brown acquiesced in the view that the natural tendency of the European coal famine is to increase cost of production and prices of iron, and thus divert orders to America.

AMERICAN MACHINERY IN SWEDEN.

We take pleasure in mentioning a letter, accompanied by several catalogs, received from Graham Brothers, Stockholm, Sweden, who call attention to the fact that Sweden is not behind the times in adopting improved machinery. It is stated that nearly all the prominent machinery houses of America are represented in that country. The sales of Graham Brothers last year included twenty-three American locomotives, five 500-ton coal-handling machines of the Brown Hoisting and Conveying Machinery Company's make, besides Westinghouse machines and hoisting machinery, etc., of various manufacturers.

The catalogs sent by Graham Brothers are in Swedish, plentifully illustrated and of attractive appearance. One is devoted to Richmond compound locomotives, one to Westinghouse engines, one to hoisting apparatus of the American Hoist and Derrick Company, another to Standard Pneumatic Tool Company's and Boyer pneu-

matic tools and Ingersoll-Sergeant air compressors, still another to Magnolia anti-friction metal. Such publications as these go to show that American machinery is commercially established, even in countries removed from the main routes of travel, on a broader foundation than is generally realized.

Commercial Review.

NEW YORK, SATURDAY EVENING, March 24, 1900.

DYNAMOS AND MOTORS.

Several features and examples of business in the local electrical machinery market bear the aspect of a lull, a precursor, perhaps, of spring trade. Some of the sellers of direct-current apparatus complain that there is not very much demand for small motors, that while considerable inquiry for generators prevails, orders for them have not lately been closed up with the eagerness that has been seen of yore. The factories are still well supplied with work ahead, but not so crowded as to be unable to accept contracts for quicker delivery than has heretofore been possible. A generator not larger than 75 kilowatts' capacity can now be obtained in thirty days, the time required by a company that has caught up with orders by extra effort and night work, rather than through any slackening of demand in their case. Most manufacturers would still require more than a month for a generator of the size named. Four and a half to five months on a 400-kilowatt machine is an estimate named by another seller. Still another concern, instead of making easier terms, asked six months to ship some 65-kilowatt motors, but finally agreed to do so in three.

The financial collapse of the Third Avenue surface road of this city raises the question of what will be done as to completing the construction of its new power plant of about 100,000 horse-power. The Westinghouse interests have the contract for the equipment of this new plant, including engines and generators, now building, and boilers, which they have ordered of the Babcock & Wilcox Company. It is reported that the completion of the plant has been abandoned, that the contracts for equipment have been canceled, and that since the acquisition of the road by the Metropolitan Street Railway Company, arrangements will be made to take current from the new plant of the New York Gas and Electric Light, Heat and Power Company. The close relations understood to exist between the Metropolitan Traction and General Electric interests would indeed appear unfavorable to the Westinghouse Company. We have given the matter a little further investigation, and find there is fair reason to believe that not only have the contracts not been canceled, but that the work will go ahead with some modifications in matter of detail, bearing upon the relations of the Third Avenue and Metropolitan plants.

In New York and other large cities the clothing trade creates a demand for small motors, chiefly for running sewing machines. The clothing manufacturers make their goods in the spring to supply the fall trade, and *vice versa*. A dearth of sales of small motors now prevailing at a local office is attributed to the season's having been too early for a harvest of orders from this source. In the same office the motor trade has lately been running more exclusively than usual on motors of medium size, *i. e.*, about 15 horse-power, for machine shops and kindred purposes.

The Stanley Electric Manufacturing Company made an advance in prices of 10 per cent. the first of this month, making an increase of slightly more than 30 per cent. in a year past. Last week the company booked an order for fifty motors from an automobile manufacturer in Illinois.

The C & C Electric Company has lately closed the largest contract in its history. This is for forty coal cutters, entire, capable of cutting in 6 or 7 feet. The order was received from a selling company. The Philadelphia "Call" has purchased a 35 horse-power special C & C equipment for a Goss press, and has an option on a second. The company's sales in Chicago in the last thirty days have exceeded those of any equal period in four years. A recent order received by the company is for motors aggregating 200 horse-power for a railroad machine shop in southern Indiana. For addition to the equipment of the C & C Company's own shop have lately been purchased a 5-foot boring mill, a radial drill, milling machine and saw.

Apropos of the machinists' strike question it may be of interest to note that entire harmony between the company and the men is said always to have prevailed at these works, and of the 225 employees about fifty have been there five or six years, some of them since the inception of the business. The shop is a non-union one, and a system is followed which is spoken of as a compromise between the premium and piece-work plans.

Twenty motors of the Northern Electric Manufacturing Company, ranging in size from 5 to 20 horse-power, were shipped Wednesday on the steamer "Kensington" for use on "Pearson's Magazine," London. The Bullock Electric Manufacturing Company furnish some larger motors for the same plant, as has previously been announced.

Acheson, Harden & Co., Passaic, N. J., handkerchief manufacturers, are fitting up a plant for which an electric current will be furnished by two 75-kilowatt Siemens & Halske generators, and will drive the machinery by Bullock motors.

The new foundry of the General Electric Company is receiving a 250-foot addition, increasing its size 50 per cent. The controller and supply department is also being enlarged. The company is getting deliveries better in hand, and can now turn out big generators in about eight months.

MISCELLANEOUS.

The Hyde Windlass Company, of Bath, Me., is rushed with orders, and is now as much crowded for room as before moving into its present new quarters. The machine shop will have to be enlarged with the addition of the new foundry. Work is now being pushed on another big windlass to be shipped to England for one of the steamships building there for the American line. These windlasses weigh, crated, over 40 tons. They are built to hoist a 3¼-inch chain, and the main shaft is 12 feet long, 10½ inches in diameter, and weighs 2 tons. The Windlass company is also building the windlasses for three of the monitors of the Connecticut class building in different parts of the country.

The director of public works of Philadelphia has awarded the following contracts for the water bureau: Holly Manufacturing Company, two triple-expansion pumps, capable of pumping 10,000,000 gallons of water into the reservoir every twenty-four hours, at $51,200 apiece, the first to be finished in 150 days and the second in 200 days. Walker & Kepler, two engines at $1,000 each, and two electrical generators at $954.40. Robert Wetherill & Co., of Chester, four boilers at $4,750 apiece, to be completed within 206 days. Palmer & Queen, conduits and pumping wells at Queen Lake Reservoir, for $53,000.

A representative of the Nova Scotia Iron and Steel Company is reported to be in Pittsburgh to secure bids on the construction of a large steel pier, storage pockets and a lateral railway to reach the mines of the Company at Wabana, Belle Isle, Newfoundland. It is stated that the company has contracted with steel concerns of the Pittsburgh district to deliver a supply of 190,000 tons of ore this year.

The Climax Manufacturing Company, Corry, Pa., ship this month one of their locomotives to Cape Nome, Alaska.

The folly of over-capitalization seems to have been recognized by more than one automobile transportation concern which started in nominally on the scale of a trunk line railroad. It is announced that the directors of the New England Vehicle Transportation Company have recommended a reduction of capital from $25,000,000 to $5,000,000. Likewise the directors of the Illinois Electric Vehicle Transportation Company have voted to advise its stockholders to trim off a few shavings, amounting to 90 per cent. of their capital stock, thus reducing it from $25,000,000 to $2,500,000. The pictures of the directors of the two companies ought to be emblazoned in a souvenir volume and a copy presented to every industrial corporation in the country.

CHICAGO MACHINERY MARKET.

It is the estimate of several machinists'

supplies houses in Chicago that their loss of trade locally in consequence of the machinists' and building trades' strikes is from 50 to 60 per cent. This loss is therefore severely felt by those houses which deal mainly or largely with the local trade. But the purely local trade does not equal 25 per cent. of the total from this distributing center, and when that is figured in the percentage of loss fades into much less consequential proportions. The country trade shows no diminution. On the contrary, it is inclined to improve. It affords a criterion of what the conditions would be were the shop difficulties wholly eliminated. Some houses in the aggregate find business about the same as a month ago, and considerably better than a year ago. March is a good month usually for machinists' supplies, and there would be a noticeable gain if things were not awry. The lines that are most noticeably affected are machinists' tools, drills, files, emery wheels and similar goods, used directly in the machine shop. Furnishings not quite so direct, as brass goods, etc., are selling at pretty much their old point of activity. The almost complete tie-up of the building trades is beginning to affect unfavorably also business in the equipment of shops, both old and new. There is enough of this kind of work projected and under way to make trade for the shop-fittings people brisk, but with scarcely a hammer sounding in construction work the shafting, belting and power transmission trade generally within the limits of the city is dulled. Perhaps the policy of the generality of buyers is to limit purchases to barest necessities in the line of shop accessories. That, with these conditions prevailing, the volume of business should even approximate the trade of a year ago is a commentary on the buoyant spirit which pervades the machine trade in general.

Foreign orders are most excellent, and with the country shops buying regularly, the machinists' trade on the whole may be said to be eminently satisfactory under the prevailing conditions.

Among the orders received recently by the Reeves Pulley Company was one for a power transmission equipment for the Chicago Coated Board Company, which has just doubled its plant capacity in this city, the order consisting of belting, gears, etc.

The Armstrong Brothers Tool Company is meeting with a steadily increasing foreign trade. An order recently received from Belgium was the largest they have ever booked. It consisted mainly of their tool holders.

CINCINNATI REPORT.

Notwithstanding the somewhat threatening aspect of the machine and tool making horizon in a labor way, the Cincinnati colony pursues the even tenor of its way, and as yet not a single discordant note has been heard. The companies, however, are alert and watchful. With orders in calling for the full capacity of the shops for the next four months, without any additional orders, they realize that the situation calls for the most careful management. Organizer John J. Connolly, of the International Association of Machinists, has been in the city several days, getting in touch with the local men, and expects to return April 8 and take charge of a mass meeting of union and non-union men called for that date.

It is only in the event that local concerns take work from those of Chicago, Cleveland and Columbus that an uprising is anticipated here. A consensus of opinion from a dozen of the largest machine tool making concerns in Cincinnati indicates that the men are, as a rule, perfectly satisfied with their wages and treatment.

As to trade conditions, manufacturers report a largely increased demand from the Far West, and the same is true of the South with inquiries for the best class of goods. Formerly—and this is more particularly true of the South—the demand has been most conspicuous for second-hand tools. The orders so far during the new year indicate conclusively that better conditions prevail in all lines of business, and the tendency is towards expansion and progression. The E. A. Kinsey Company, large local dealers and jobbers of tools and machinery supplies, report orders from Birmingham and the South generally for a much better class of machinery, with inquiries for second-hand goods lessening perceptibly. Prices, they say, have about reached the maximum, and are expected to hold firm from now on during the period of greatest demand. President E. F. Hargrave, of the Cincinnati Tool Company, is heard from in the Mexicos, with some excellent orders. He reports the feeling exceedingly good there, and a tendency to order more extensively and better classes of goods. He is expected to return about April 1. At the office of the company in Cincinnati it was learned that mail orders have increased wonderfully, which satisfies the firm that the demand is unusually good, and that the feeling is for better financial conditions throughout the country generally.

The Cincinnati Machine Tool Company has work to demand the full capacity of the shops for the next four months without an extra order. Plans are drawn for an addition to the machine shop, which will afford double the floor space. A big Jones & Lamson lathe and a Bickford radial drill are to be installed in a few days. Greaves-Klusman Company are getting out a new 20-inch engine lathe to be placed on the market in a couple of months. Manager W. F. Hays, of the General Electric Company's Cincinnati house, reports an increase in the demand for power apparatus of about 200 per cent. over usual conditions. The unusual good business of this house has drawn a congratulatory letter from the president of the company. The Cincinnati Radial Drill Company is enjoying an increased demand for drills over that of last month. This company, in common with many others here, received a letter of inquiry from the Bombay, India, agent asking after prices and urging a representation in that city and Calcutta of American made machinery.

Mr. Murray Shipley, of the Lodge & Shipley Machine Tool Company, who has been looking over trade conditions and possibilities in the South, is expected here on Monday. Letters from him have indicated a very general satisfaction with trade conditions in the lower United States. He arranged for better representation in those districts not already covered. Col. J. S. Ward, of Madison, Ind., accompanied by Charles R. Johnson, proprietor of a large brass foundry there, visited the chief machinery centers here during the week and made some purchases.

The Lodge & Shipley Company shipped eighteen lathes to Europe this week and filled cable orders from London for eight machines the previous week. Prices rule firm, but it is the opinion of this, as also the other conservative larger concerns, that the labor conditions may send them up higher.

Quotations.

NEW YORK, Monday, Mar. 26, 1900.

A wave of quietness has struck the iron and steel markets.

Iron—American Pig, tidewater delivery:—

Pennsylvania Irons:	
No. 1 X foundry	$22 70 @ $23 20
No. 2 X foundry	21 70 @ 22 45
No. 2 plain	20 00 @ 20 70
Alabama Irons:	
No. 1 foundry	22 25 @ 22 75
No. 2 foundry	21 25 @ 21 75
No. 3 foundry	20 25 @ 20 75
No. 1 soft	22 25 @ 22 75
No. 2 soft	21 25 @ 21 75
Foundry forge	19 75 @ 20 25

Bar Iron — Base sizes — Refined, mill price on dock, 2.10 @ 2.25c.; store price, 2.45 @ 2.60c.; common from store, 2.40 @ 2.50c.

Tool Steel—Base sizes—Standard quality, 7 @ 8c.; extra grades, 12 @ 14c.; special grades, 16c. and upward.

Machinery Steel—Base sizes—Ordinary brands from store, 2.85 @ 3c.

Cold Rolled Steel Shafting—Base sizes—From store, 4 @ 4.25c.

Copper—Lake Superior ingot, 17c.; electrolytic, 16¾ @ 16⅞c.; casting, 16.70 @ 16.75c.

Pig Lead—Wholesale lots, 4.70c., New York delivery; carloads, 4.72½ @ 4.77½c.

Pig Tin—In 5 and 10-ton lots, f. o. b., New York, 30¾ @ 31c., spot.

Spelter—Prime Western, 4.60 @ 4.65c., New York delivery.

Antimony—Cookson's, 10.95 @ 11⅛c.; Hallett's, 9¾c.

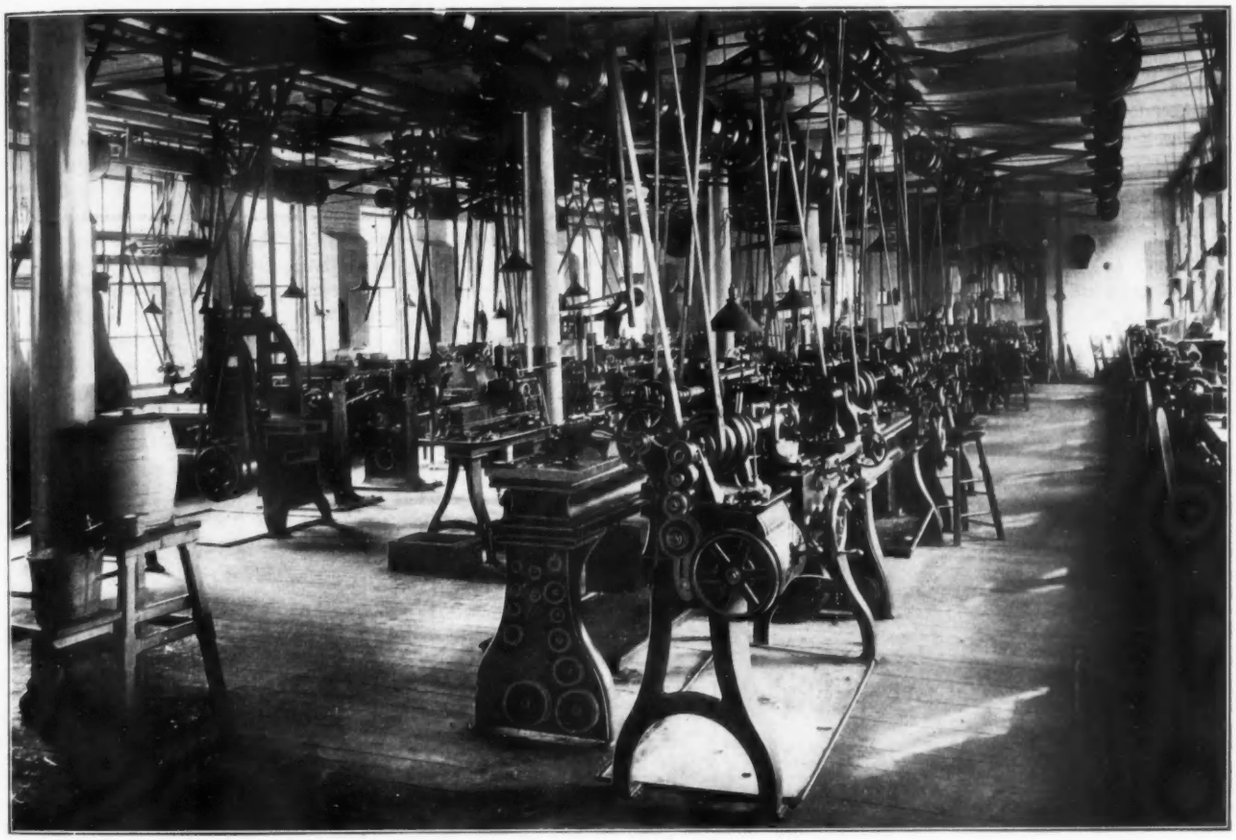


FIG. 17. MACHINE SHOP, OR TOOL ROOM, "HILL SHOPS," SPRINGFIELD ARMORY.

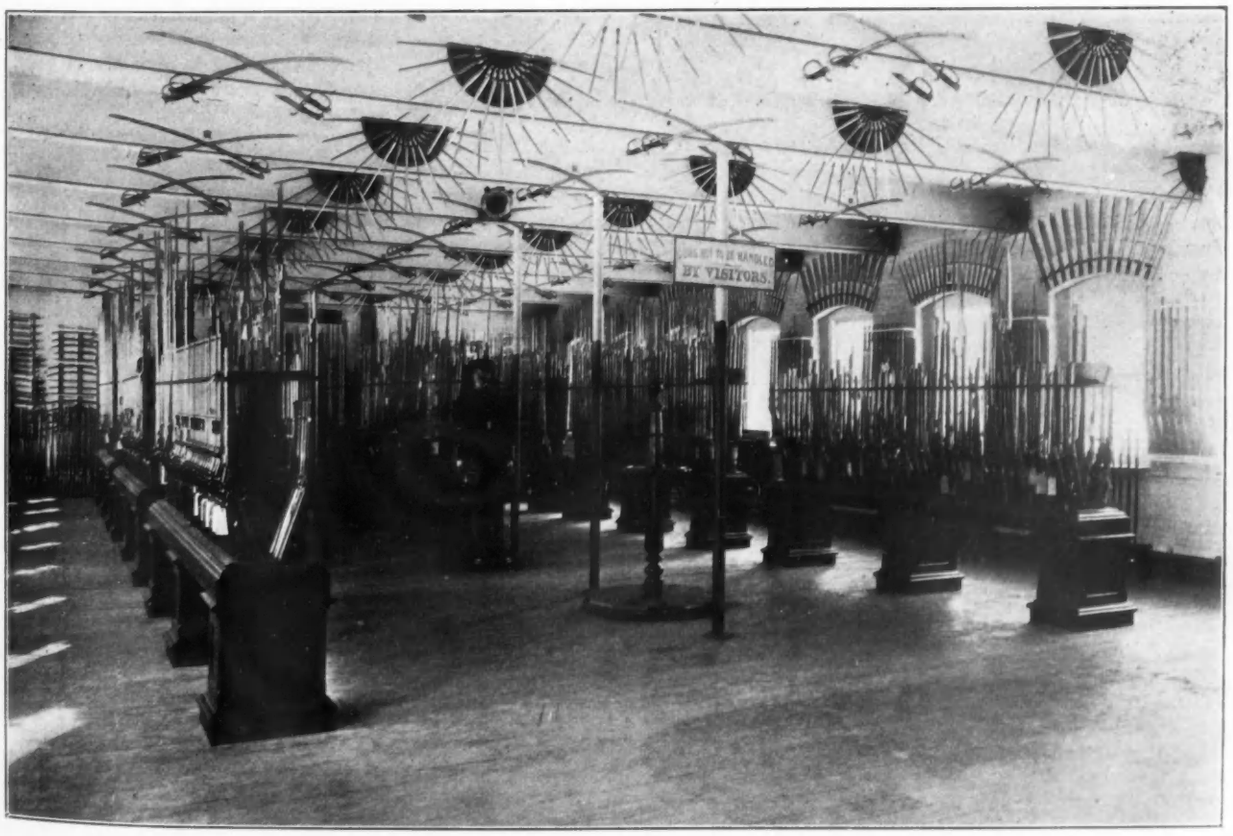


FIG. 18. MUSEUM AT SPRINGFIELD ARMORY—COLLECTION OF MILITARY FIREARMS.

The United States Armory at Springfield, Mass.—II.

BY D. E. MACCARTHY AND F. J. M.

Our readers will readily believe that tool-making plays an important part in the work done at the armory, and in Fig. 17 we give a view in the tool room, or, as it is there called, the "machine room" at the Hill Shops. This view gives but one end of it, however, the room being in reality 500 feet long by 50 wide. During the rush occasioned by the Spanish war about 125 toolmakers were at work here. The room is equipped mostly with the best of standard modern machine tools, although many of the old lathes, made by builders long since out of business and forgotten, are still doing duty. One of the lathes most familiar to our readers is seen in the foreground of the picture.

At Fig. 18 is a view in the museum, where are collected a very great variety of small arms, including nearly if not quite all that have ever been supplied to troops in any country, besides some experimental weapons that were never regularly manufactured or adopted.

The "Krag" gun is composed of ninety-nine parts. It is obviously impossible for us to describe all of these or the operations performed upon them, even if it were desirable to do so. Many of the operations are of course without special interest, or are very much like those performed in doing other work, such, for instance, as is done on sewing machines, typewriters or bicycles, though the work is more carefully done, and is of course very far superior to that which is found upon most bicycles. As is the case in all small-arms factories, much use is made of the Lincoln miller, and a favorite form of fixture used with it is shown by Fig. 19.

The cast-iron base is kept always in stock in various sizes, and requires finishing only at *a, b, c, d, e, f* (end view), which surfaces are milled up with gang cutters. The jaw *A* is often arranged to swing on a bolt to grip irregular pieces. These milling fixtures are made double, and sometimes triple, for milling the smaller forgings, requiring only a base with two or three slide-ways. The jaw *A* is the moving one; *B* is fixed. *C* is the cam by which the jaw *A* is moved, and, in the case shown, D is a seat for the extractor, and is shaped to fit it. By change of this support and an occasional modification of one or both jaws the fixture answers for a great many different operations, and the base, slide, cam and jaws are regarded as standard.

Mr. Brooks considers the "face milling" that is done here as one of the best things that have ever been introduced into the armory, and it certainly is very expeditious. It is used on such pieces as the

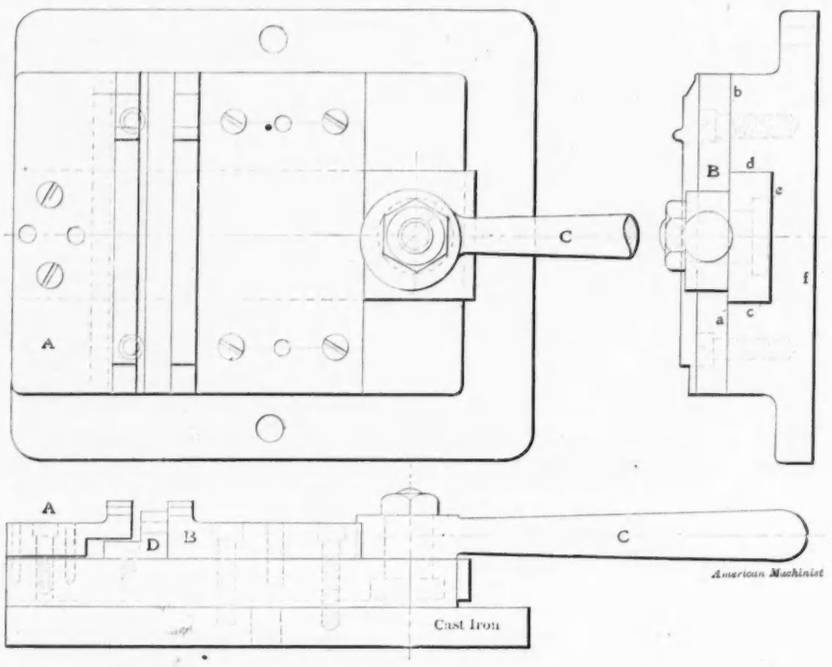


Fig. 19

MILLING FIXTURE USED WITH LINCOLN MILLERS AT SPRINGFIELD ARMORY.

FIG. 20. TOOLS FOR FACE MILLING THE TRIGGER.

triggers and other parts that are to be milled with flat parallel faces, and in some cases where there are shoulders as well. At Fig. 20 is a photograph of the tools for face milling the trigger. There is first a flat steel plate or base that stands upon four short legs, and is provided with a handle for the convenience of the operator. Hinged to the back of this is another steel plate which is somewhat thinner than the piece to be milled and is perforated with holes that are just the right form and size to correspond with the profile or outline of the work. Provision is made for locking this plate at the front, as shown, and when it is so locked the holes are filled with pieces to be milled, the fixture passed under the vertical spindle of the milling machine used on this job until the guide-tit enters the hole in the fixture, and thus locks the milling cutter and the fixture together, so that there can be no displacement nor any stress caused by an unequally distributed cut that must be resisted by the spindle of the machine. A suitable stop defines the thickness of the piece, and when the cut is finished the opening of the hinged plate permits every chip to be surely removed, so that there is no trouble from that source, as there might be were the holes for the pieces sunk into the solid plate. The arrangement of the cutters will be readily understood from the photograph. In this case there are three of them that are secured to the shank, which is provided with a flange through which screws are passed into the cutters. In the case of this particular piece, the inner cutter is higher than the others to give the required shoulder on the side of the trigger, and the blanks must be arranged in the fixture as shown, in order to locate this shoulder properly. Where the piece operated upon is without shoulders, they are put in in any order that will enable the greatest number of pieces to be placed in the fixture at one time. With well-made fixtures and cutters and with a good stiff and powerful milling machine, the work is done very rapidly indeed, its manifest advantages being that remarkably little time is consumed in putting work into and removing it from the fixture, as compared with other methods, and besides, many more pieces are operated upon at one time than is usually possible by other methods.

MAKING THE GUN STOCK.

The manufacture of the black walnut stock involves a shop in itself. The finished stock is no doubt one of the finest pieces of workmanship, in wood, that could be found; every curve and corner is made accurately to gages, by special machinery.

One or two interesting historical incidents are connected with this machinery, the most interesting being the invention of the first machine for turning irregular forms in wood. Previous to the year 1820, the gun stock was cut out entirely by hand. At that time Thomas Blanchard, an employee of this department, evolved the idea of turning the stock in a machine. His first study of the subject was followed by developments in the shape of brown-paper sketches, which were promptly taken up, a machine made and put in operation, and so admirably did it work that but few changes have been made in the original design.

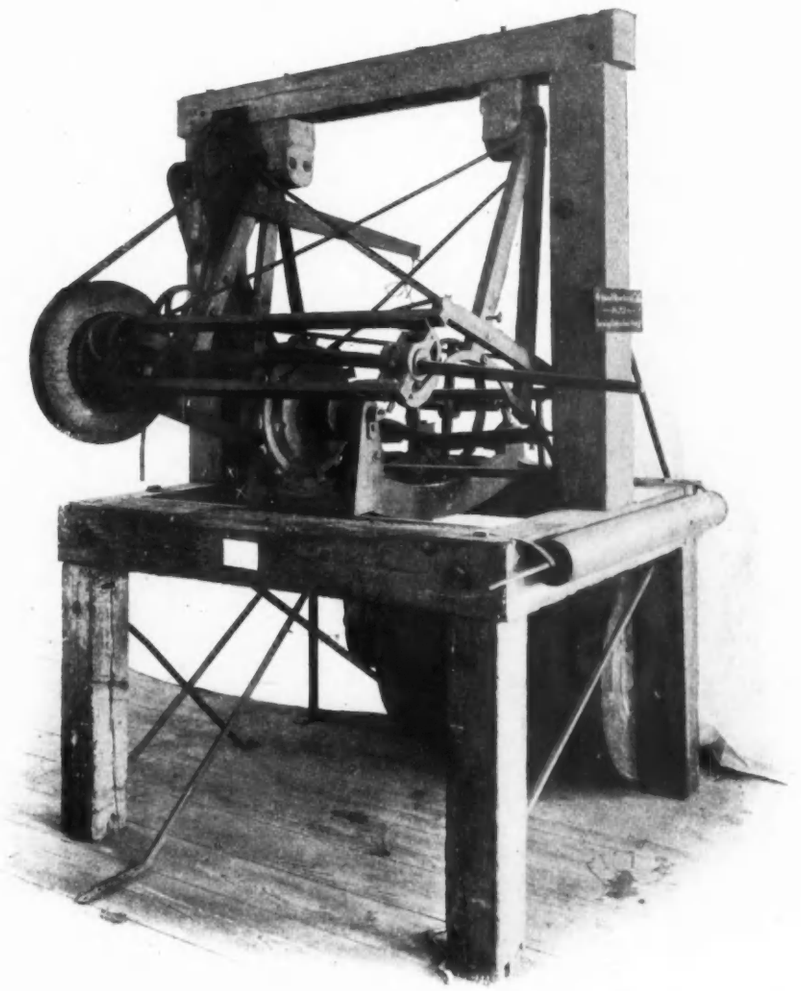
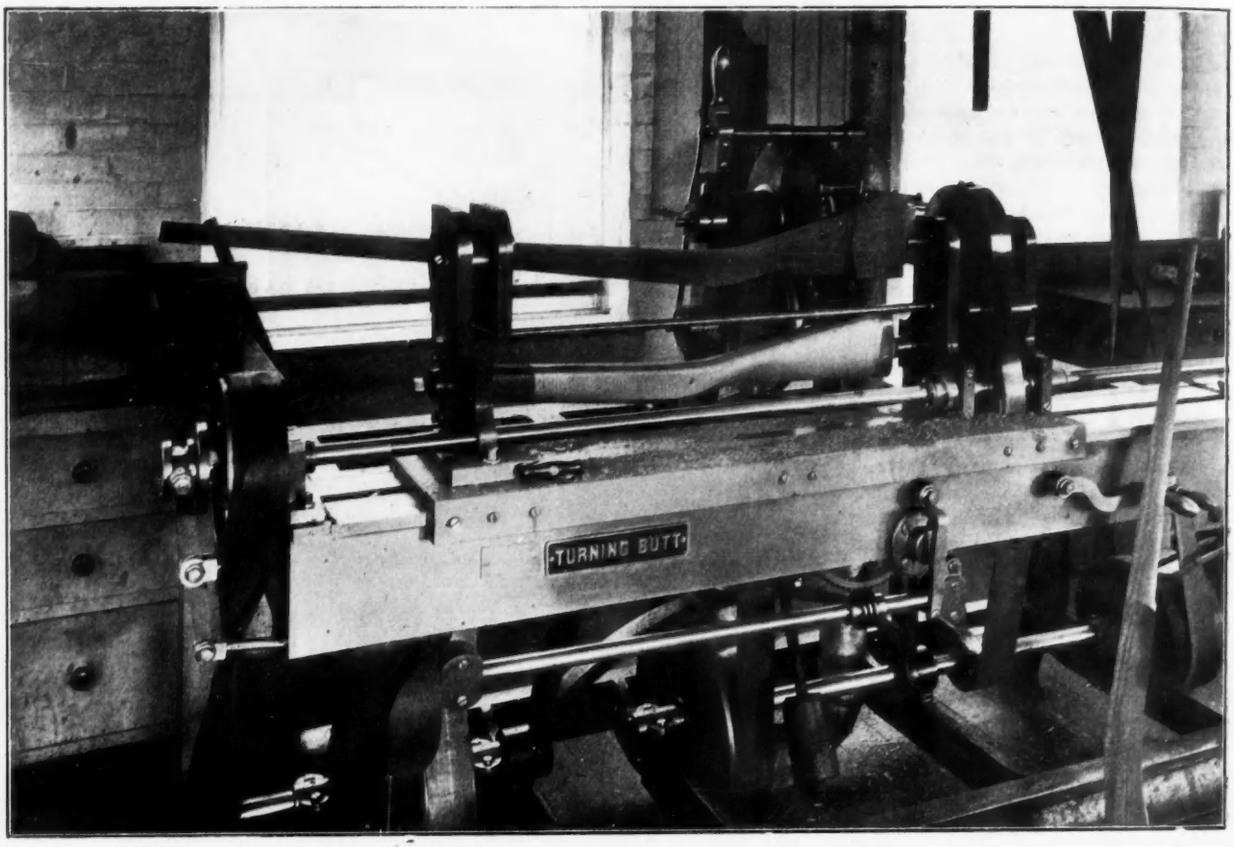


FIG. 21. THE ORIGINAL BLANCHARD LATHE, IN MUSEUM AT SPRINGFIELD ARMORY.

At Fig. 20 is a photograph of the original machine, which now occupies a place of honor in the armory museum. It was built, as the placard states, in 1822, and constitutes the beginning of what is now known the world over as the Blanchard lathe, and which turns not only gun stocks, but shoe lasts, vehicle wheel spokes, wooden tobacco pipes, axe and hammer handles and very many other irregularly formed articles of wood, while the toolmaker and machinist also make use of its principle in cam-cutting fixtures and other devices. There is, of course, no need to explain it, as its principle is familiar, and from the photograph it is easy to trace out the means by which Blanchard accomplished his purpose, and by which the form of an iron stock once made and placed in the machine is reproduced in wood by means of the rotary cutter seen near the front of the machine, and which was driven from the drum below, while the model and the piece operated upon are made to rotate together by means of the wooden pulley and train of spur gearing seen at the left. The principle of the machine seems simple enough to us now. In Blanchard's day it was not so simple, and his idea was one of those strokes of creative genius that are very rare, and at the same time of the utmost importance, industrially and socially.

The introduction of this machine revolutionized the manufacture of the gun-stock and, though Mr. Blanchard received much praise for his invention, very little money ever came to him. The invention was not kept secret nor patented, and soon machines were introduced for turning all manner of irregular shaped pieces, all being the direct outgrowth of Blanchard's machine. In 1855 the English Government obtained permission from the Secretary of War to inspect the processes used here for gun making, and to make drawings and collect other information. So well did they avail themselves of this privilege that the new gun-stock turning



FIRST OR ROUGH TURNER FOR GUN STOCKS. SPRINGFIELD ARMORY.

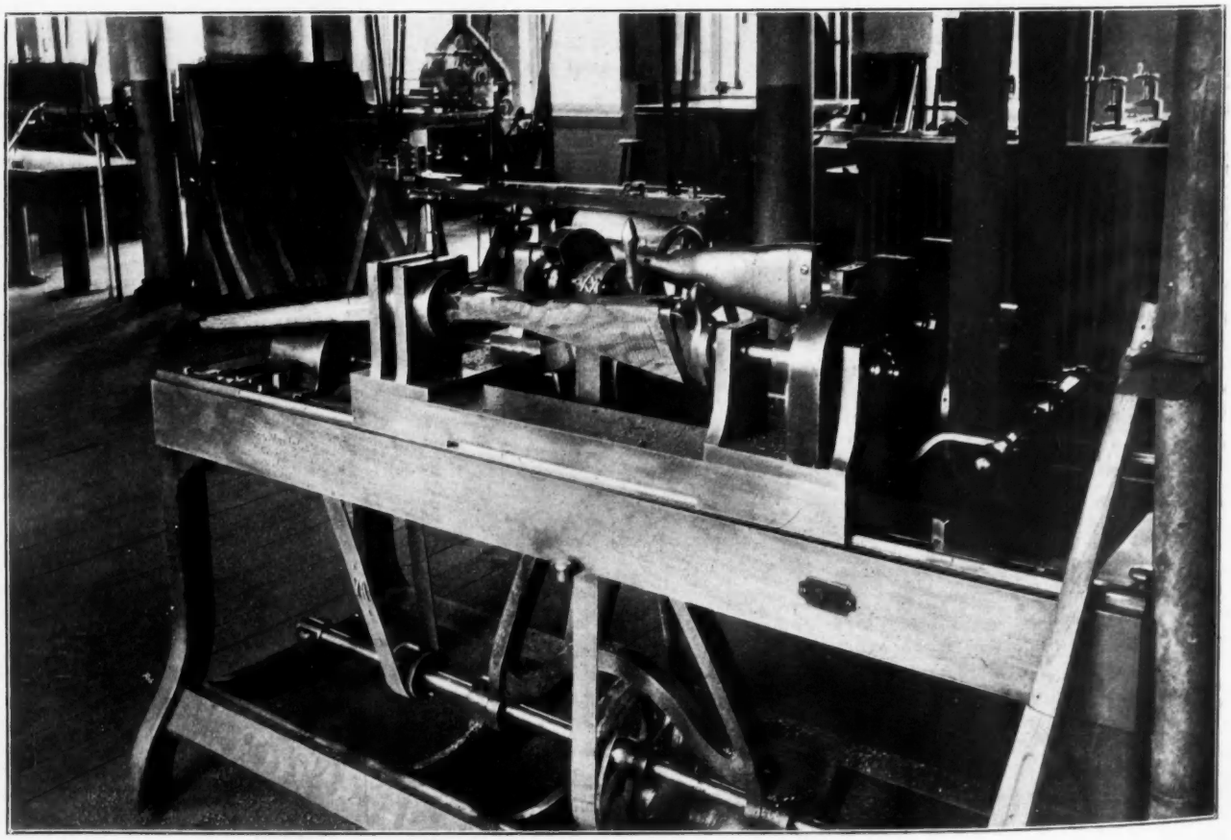


FIG. 22. SECOND OR FINISH TURNER, STOCKING SHOP. SPRINGFIELD ARMORY.

machines, and other tools, were copied and models made by a machine firm in Chicopee, Mass., which were later taken to the Government shops at Enfield, England, where they were set up and put in operation by American mechanics, and have since been in constant use.

Two of the machines at present in use for this work at the Hill Shops are shown in Fig. 22. The first of these takes the first or rough cut over the stock, and the other, with a much finer feed, prepares it for the finishers. They are, of course, Blanchard lathes, though in a different form from his first machine, and are arranged to swing the cutter head and the contact wheel in a frame pivoted near the bottom of the machine, instead of swinging the model and the work in a frame pivoted at the top, as is the case in the original machine shown in Fig. 21.

Other interesting machines used in the "Stocking Shop" are shown in Figs. 23 and 24. The first of these is called the "barrel bedding machine," and is based somewhat upon the principle of the profiling machine. It cuts out the various fitting spots, barrel groove and receiver bed, and does it by means of copying a steel stock, which is placed on the bed alongside of the wooden one to be operated upon, so that forming pins bear upon this steel model while the cutter operates, the moving of the latter being controlled by the former. The various cutting spindles are brought down into operating position by the hand levers seen, and only one spindle is in operation at a time, being driven only when in use by means of friction wheels. The horizontal spindle at the right cuts the long groove for the barrel.

Fig. 24 is a machine used for a similar purpose, but has its spindles arranged on a turret, so that the one to be used is brought into position by a rotating movement.

At Fig. 25 are seen two racks filled with finished rifles. These are used in the assembling room and are on castors, so that they may be easily moved about. At Fig. 26 is the testing machine by which all steel used in the manufacture of the rifle is tested, and this is provided with the latest device for moving the beam weight outward by the rotation of the screw which is set in motion for that purpose automatically whenever the beam by its rising makes the electrical contact seen at the top.

At one end of the drafting room, on two brick piers, stands the comparator, which is the final reference for exact sizes of all gages and tools used in the armory. It was made at the Watertown arsenal, and consists essentially of a bed at the top of which is a rectangular guide to which are fitted two sliding heads provided with contact pieces, and one of them with means for fine movement. Mounted upon this is a microscope with micrometer eyepiece, and at the back side is a bar of steel extending the whole length of the machine, into which at short distances apart are set round steel plugs, upon the highly polished upper ends of each of these plugs being a fine line drawn with a diamond. This bar is of course the real standard, the balance of the machine being simply a means of comparing other things with it. It has a capacity to make measurements up to 70 inches in length. Back of the machine, under a shelf, may be discerned a half-tone print of the great gun lathe at Watervliet arsenal for boring and turning 16-inch guns, which print was a supplement to our number for April 9, 1896, and has been placed there by some appreciative draftsman as an appropriate decoration for the walls of a room in which they deal with problems connected with the production of much smaller, but probably equally important guns.

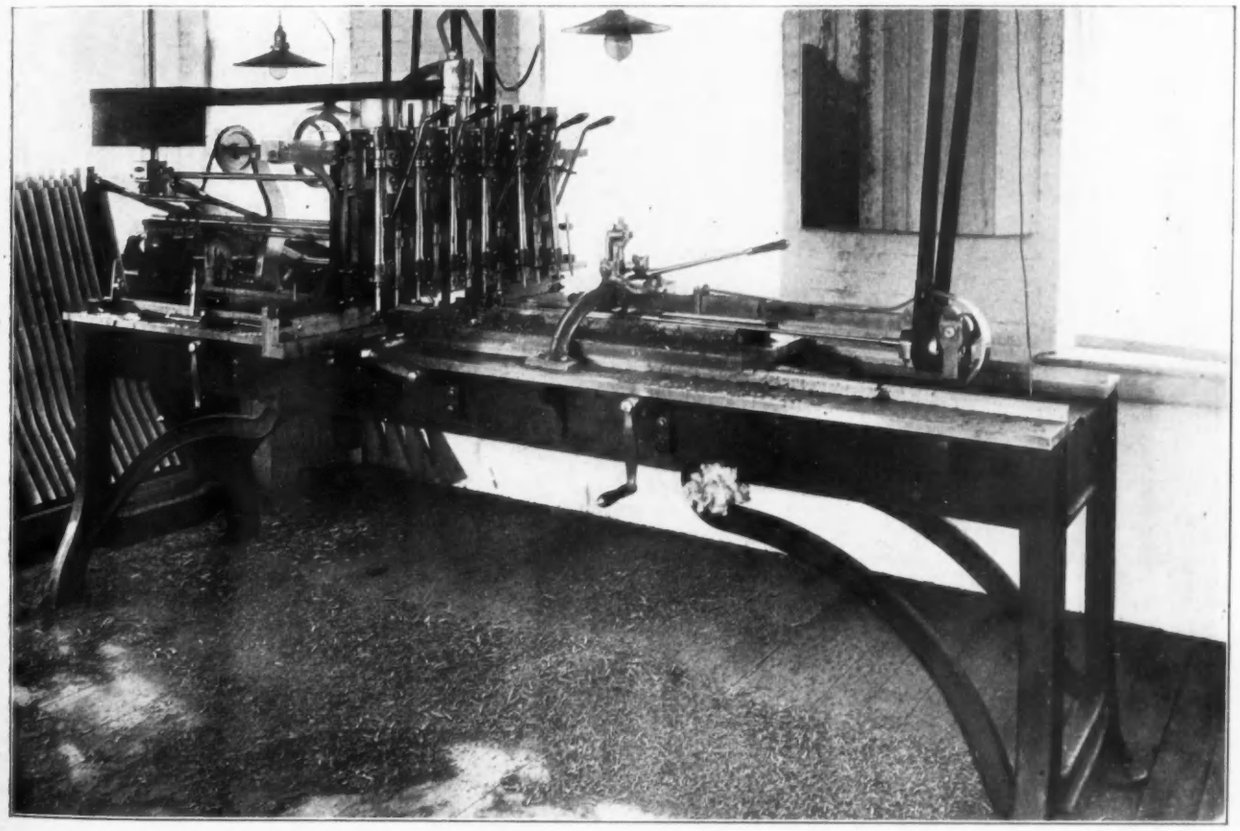


FIG. 23. BARREL BEDDING MACHINE.

We have all heard of the man who sat on the limb of a tree when he sawed it off. A parallel trick was recently performed at a certain machine shop within the range of our acquaintance. A large horizontal overhead belt was to be removed, and a machinist got up on it and cut the lacing, letting himself down anything but gently.

The second sale of Mauser rifles captured in Cuba and Porto Rico from the Spaniards took place at the Springfield Armory a few days ago, and 10,000 rifles and 5,000,000 rounds of ammunition were disposed of.

Technical Education—An Economic Necessity.*

I have chosen as my theme "The economic aspect of technical education" because I desire to maintain the following proposition, viz.: the continued growth and prosperity of any nation depend ultimately upon the technical education of its people. I do not claim that business success, industrial prominence or material wealth are the only desiderata for a nation or for an individual, but I do urge that material prosperity, widespread and universal, is an essential foundation for artistic, philosophic or literary prosperity. The man who does most towards increasing the general material prosperity of a country, who calls to the aid of mankind all the forces of nature, is the man of applied science—usually called an engineer.

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The natural products of a country, as coal and iron, may be sufficient, for the Lord seems to have dealt more bountifully with some than with others; or, a nation may, by its own efforts, bring about success. How can this be done? I believe that the most important element in giving one nation industrial supremacy over another is the technical education of its people. Foreign agents, consular reports, natural inventive ability, keen business sense, all aid, but they are, individually and collectively, inferior to the power that comes from having the workman, the superintendent and the manager, each carefully trained to do his own moiety in a superlative manner.

Let me give an illustration: In 1883, at Crefeld, Germany, there was founded, at a cost of $210,000, a school for the sole purpose of teaching weaving and dyeing and such parts of the allied arts and sciences as were useful in the weaving and dyeing industry. The school was founded not as the result of any demand on the part of the merchants or the people, but as the result of the far-sighted policy of German thinkers who recognized the need of technical skill in the weaving industry. The outcome was remarkable in the extreme, affecting not only the textile industry at Crefeld, but in all Germany, to such an extent that silk goods formerly made in France are now made at Crefeld and exported to France. The city dates its rejuvenation from 1883, when the textile school was established. Since that time the city has prospered marvelously. The school itself has served for a model for schools the world over. The possession of its certificate is a sure passport to employment, for the manufacturers in the textile industries seek out and employ the graduates, well knowing that their own business success lies in having competent and thoroughly trained workmen.

And yet in Manchester, England, where the weaving and dyeing industries are of greatest importance, they are just beginning to establish a school of weaving and dyeing.

Let us now focus our attention and consider England, Germany and the United States, their relations to each other and their relative places in the contest for industrial supremacy. For three centuries England had been laboring industriously to acquire and to hold the commercial supremacy of the world. The extension of her empire has been along the lines of trade and traffic. She has used, as a means to this end, legislation to improve the condition of the workmen, subsidies, exclusive charters and privileges, early development of inventions and correct business principles. To a certain extent she has been successful—she has been mistress of the seas; she has monopolized the business of the world. But that a revolution has been in operation during the last quarter of a century no calm observer of the trend of events will deny. England has been steadily losing ground, and if she continues to lose her foreign trade as rapidly during the next quarter of a century as she has in the past, she will soon lose her commanding position. In 1870, Great Britain, exclusive of her colonies, did one-quarter of the world's commerce, and including her colonies, 35 per cent. In 1895 her share had fallen to 18 per cent., or, including her colonies, to 31 per cent., showing that while she still held the lion's share, that share was steadily diminishing. From another point of view: Between 1870 and 1895 British exports increased 13.17 per cent.; Russian, 17.35 per cent.; French, 20.40 per cent.; German, 42.90 per cent.; while the exports from the United States increased 110.66 per cent., showing that during the last quarter of a century England's commercial advance has been the least of all.

Here is a condition the explanation of which is interesting alike to the Englishman, the German and the American. The average Englishman is primarily a business man, a trader, a man of facts and experience; and he frequently assumes a state of inordinate self-complacency. The average German is a man of details, but also of ideals. The average American is not only a man of facts and ideals, but an inventor as well. The downward tendency of English trade was first noticed by some far-sighted Englishmen, about 1881, who saw that some of the markets

*Extracts from an address before the Central Railroad Club by Professor V. M. Alderson, of the Armour Institute of Technology.

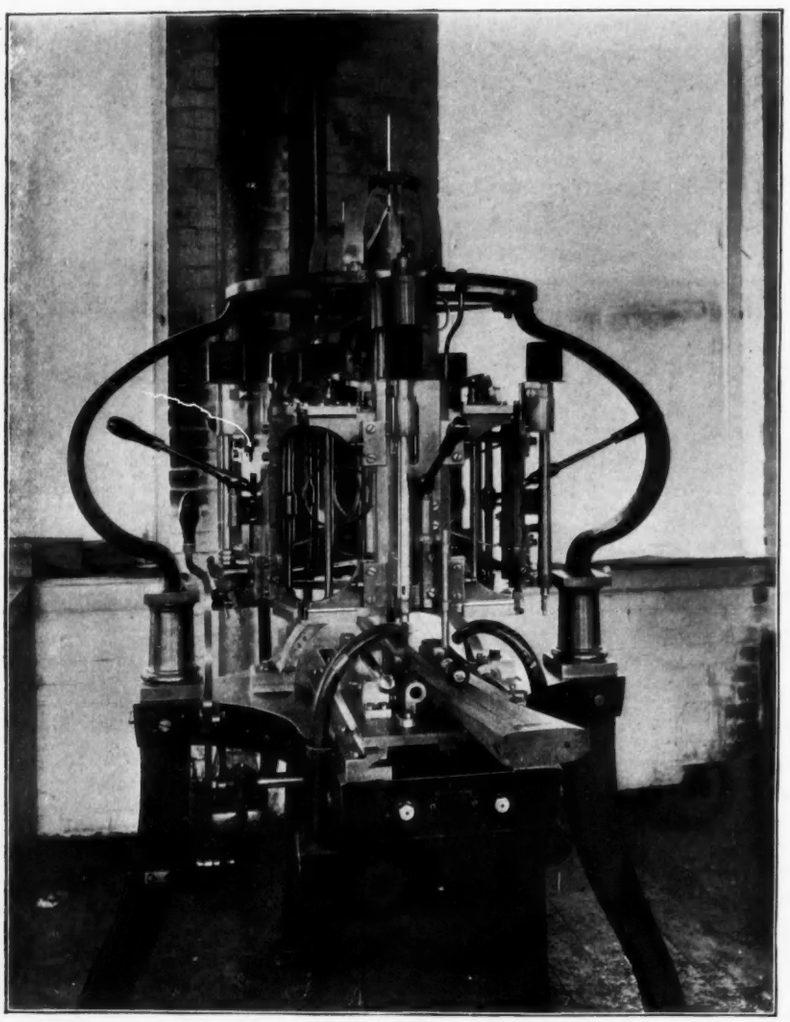

FIG. 24. BEDDING MACHINE IN STOCKING SHOP, SPRINGFIELD ARMORY.

of the world, which her business men up to that time had controlled, were slipping away from her. In true English style, a Parliamentary investigation was undertaken, which showed that two active competitors had appeared, Germany and the United States, and that a hitherto unrecognized factor had largely contributed to the success of Germany. To the Americans was given the credit of superior natural inventiveness, and to the Germans superior technical training. Strong efforts were then brought to bear upon the British Government to remedy the evil which would surely overtake British commercial interests if steps were not taken to develop a system of technical education. Parliament made some meager appropriations, but no great change came until 1890, when, by a peculiar political combination, the beer tax of 6d. per barrel, amounting to £3,750,000, was to be had for the asking. The friends of technical education were alert and succeeded in having the entire sum appropriated to technical schools. With this artificial aid they increased rapidly. In 1882 there were 1,402 schools giving technical instruction to 68,581 pupils; in 1895 there were 2,673 schools and 190,386 pupils.

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The city of Manchester, famous as a center for freedom of thought, and always alive to the interests of her people, has clearly perceived the need of technical education. Under the supervision of the efficient secretary, Mr. J. R. Reynolds, 4,000 students are now receiving technical instruction in one or more subjects. The work heretofore has been widely scattered, but on July 26, 1895, the erection of a new central building was begun. It covers a ground area of 6,578 square yards, and will cost, exclusive of ground or equipment, $650,000. The director and secretary of the work made extended examination of similar institutions in Germany, France, Canada and the United States before the plans were drawn. As at Birmingham, much of the instruction is given at night, and includes, in addition to the well-known subjects common to all such schools, instruction in gas manufacture, paper manufacture, bleaching, dyeing and printing, cotton manufacture, weaving, brick work, flour manufacture and brewing. The curriculum of the school is intended primarily to aid the development of the industries in and about Manchester, because it is recognized that only by such means can the city maintain its supremacy in the struggle for industrial success.

The Polytechnics of London cover essentially the same field as the Municipal Technical Schools elsewhere. Their instruction is generally given in the evening, and covers a wide range of subjects. Individual Polytechnics, however, make some feature more prominent than others. The Southwestern Polytechnic aims to specialize upon the higher branches of engineering work. Northampton Institute specializes on art. The most famous Polytechnic in London is the Central Polytechnic, in Regent street, founded and supported by Mr. Quintin Hogg. Its origin was humble in the extreme, being in a secluded corner alley near the Strand. Here Mr. Quintin Hogg gathered his first group of the Ragged Club, and taught them to read, using the Bible as his text, and as his light the uncertain flicker of a candle in the neck of a beer bottle. From such an origin grew the present Central Polytechnic with its 16 000 members.

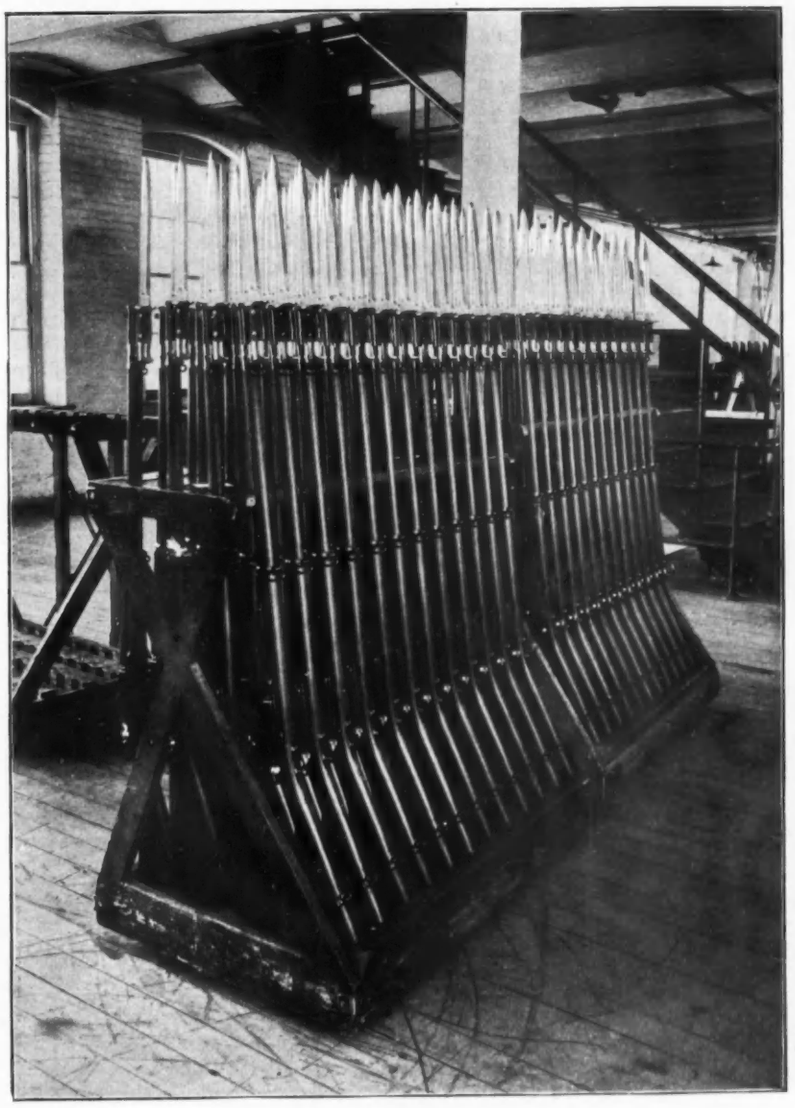

FIG. 25. U. S. MAGAZINE RIFLES STACKED IN ASSEMBLING ROOM OF ARMORY.

It is evident that England recognizes the reason for her decadence, and is supplying technical instruction to large numbers of students, but mainly through the inefficient means of evening schools. Such a plan may bring forth an occasional genius, but can never serve as a foundation for national technical training. It may make somewhat better artisans, but since it can command only the fading energy of a man who has already done a day's work, it cannot be relied upon to enable England to compete with other nations that have organized systems which demand the undivided attention of the workers. Inasmuch as England is without a general public school system, as we know it, her system of technical training is unorganized, un-coordinated and very largely what we call trade school instruction. And furthermore, it has as its persistent enemy that English bugbear—the practical man without a trace of theory in his composition, who blocks the advance of technical training in every way he can.

There are Englishmen, however, who see the great problem and do not hesitate to speak. Lord Rosebery, in a speech at the opening of the Technical Institute at Epsom in 1896, said that Great Britain was falling behind other countries in commercial enterprise from want of adequate facilities for technical instruction. And Lord Rosebery was well informed. Sir William Bailey at the presentation of prizes at the Hindley Technical School (October, 1897), said: "Those who know anything of the work done in other coun-

tries, those who have studied the progress and skill in the first principles of the arts of industry and in the scientific use of force by our competitors abroad, know very much that should discount our pride and make us feel anxious about our commercial future prosperity. Until recently technical education has been much ignored, if not entirely neglected, in this country." Sir Andrew Noble has said: "In the middle of this century English machinery was immeasurably superior to any other. To Great Britain's remaining content with this state of things, and to seriously neglected technical instruction, I attribute the very much greater comparative progress that Germany, the United States and Switzerland have made in the last fifty years." Whether the awakening has come soon enough, time alone can tell; but of the reality of the danger there is little doubt, and the efforts to combat it will surely be made with energy and ability.

All observers of German progress, regardless of nationality, unite in attributing her success to her magnificent system of education—technical, scientific and classical. Thoroughness and careful attention to details seem to be the watchwords. Each German state aims to bring its system up to the highest state of efficiency. The system of elementary schools, realschule, technische hochschule, gymnasium, monotechnic, polytechnic, university, is perfect in every detail. Every trade or craft is given its due share of attention, and its monotechnic schools are located at the convenient centers of each particular industry; but government control allows no duplication of effort nor foolish rivalry. In Prussia there are 248 monotechnic schools, distributed among the various trades, thirteen of which schools are devoted to the textile industry. High-grade technological instruction is as carefully prepared for as the more elementary trade instruction; no part of technical education is neglected.

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To show the thoroughness with which the Germans have carried out their idea, consider this: If a paper dealing with any particular phase of industry, say the textile industry, is published anywhere in the world, it is immediately translated into German and circulated throughout the textile schools of Prussia; and more, all necessary models, illustrations or lantern slides, which may serve to make the matter clearer to the student, are prepared and sent out with the paper. Their aim seems to be in this matter to know all that the remainder of the world knows and just a little more. The success of the German policy may be seen in a single illustration, which can be duplicated again and again. The Badische Anilin and Soda Fabrik at Ludwigshafen on the Rhine in 1865 employed only fifty men. Now it employs nearly 5,000 men and upwards of 100 scientificially trained chemists. Its laboratories are on such a magnificent scale as to make them superior to many university laboratories. Quite different is the state of affairs in England, where there is practically no system of public education, where the great bulk of the pupils leave the elementary schools at tender age, and where no public provision is made for systematic instruction of the academic, high-school or realschule grade. No wonder, then, that educators in England cry out with one long lament that students cannot receive the higher grade of technical instruction because their elementary and secondary education is deficient. In Germany this condition does not exist. Twenty years ago Germany began to spend vast sums of money on trade and technical schools—a procedure which, at the same time, seemed wasteful, if not worse. She carried out the plan in a broad and systematic manner, omitted no detail, and maintained it all at a high state of excellence.

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Hamburg has risen from the sixth largest port in Europe to nearly the first. Almost every issue of a German trade paper notices the building of new factories, the additions to old ones, or the launching of new industrial enterprises. German cottons are sold in Manchester, and German steel in Sheffield and Leeds. "Made in Germany" is a more common brand than "Made in Great Britain." When the English required that articles of German manufacture should be marked "Made in Germany," it was intended as a sign of inferiority—a mark of reproach. The very reverse has been true, and the Englishman saw his error when the "Kaiser Wilhelm der Grosse," one of the finest steamships afloat, steamed into the harbor of Southampton with a huge placard hanging over her side on which was printed in mammoth letters, "Made in Germany." Truly, the Teuton has put his hands deep down into the pockets of the Briton. It does not take an observer very long to recognize the supreme reason for all this; that while England may excel in some quarters on account of natural or acquired advantages, and is to-day nominally in the lead, yet she is fast yielding to both Germany and the United States.

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Knowing, furthermore, that it is necessary not only to produce a superior article at reduced cost, but also to sell the article,

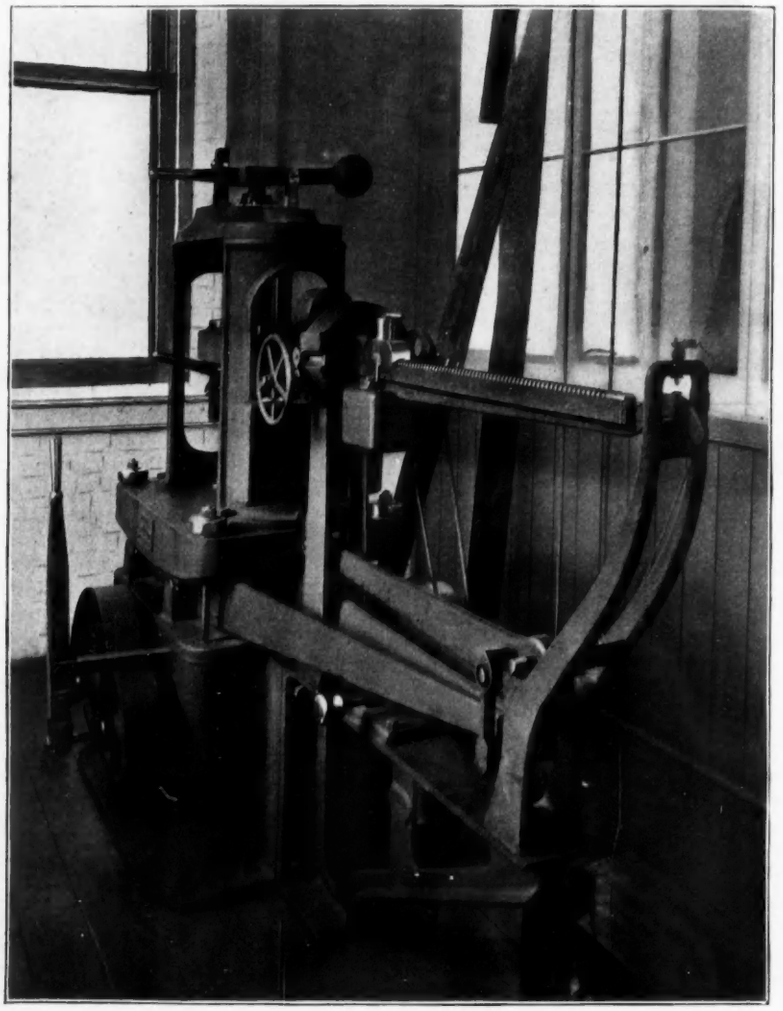

FIG. 26. TESTING MACHINE, SPRINGFIELD ARMORY.

Germany has established Colleges of Commerce as a final and necessary element in her system of technical education. These Colleges of Commerce are not merely business colleges that supplement an already defective education with the mechanical details of the counting room, but are of university rank and require for admission the same preliminary training as any other university course. The curriculum includes international law, economics, industrial history, tariff and patent laws, banking, exchange, insurance, transportation by land and water, commercial geography, products of regions, of nations, of race; maritime legislation, combinations of capital, besides all the modern languages. Such a university course will fit men for that new profession—the profession of business. The successful merchant to-day must know more, be more alert and more inventive than ever before. This action of Germany in recognizing the need of training for this higher realm of business shows her far-sightedness and will redound to her credit. In the near future she will be training not only the workmen but consuls and government agents, actuaries, auditors, department managers, buyers and sellers abroad, state, city and corporation officials, and that large circle of men engaged in the higher realms of modern business. Such training can be done as well as training for mechanical, electrical, civil or railway engineering, or for the law, medicine or theology. These graduates in the coming profession of business will give to Germany still another advantage, and we shall have to follow her lead. No American familiar with the personnel of our own consular service, our foreign agents or our public officials, can fail to see that we need Colleges of Commerce more than Germany does. We can have no better object lesson than German success resulting from the utilization of trained intelligence.

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As true Americans we should carefully examine the weak parts of our educational and industrial system and strive to strengthen them. We should not rest satisfied with the inventive genius of a Fuller, a Whitney, a Howe or an Edison, but should recognize that permanent industrial success will only come when every workman, every foreman and every superintendent is trained to the highest degree of efficiency. We need improvement in all parts of our system. It is often assumed, and sometimes it is true, that the man who has received his technological training in Europe is superior to our American home-grown product. This should not be true in any case. Our best Institutes of Technology should train men as well for the profession of engineering as they are trained in Germany or in Switzerland. The line of improvement should be first in the direction of trade schools, where special instruction should be given in the details of each trade and in the elementary fundamental scientific principles. Schools of this kind are legion; the people take kindly to them; they appeal to what is essentially practical. Their mission is to make more intelligent workmen and more useful citizens. They are essential to the welfare of the country. As illustrating what may be done in this line, consider the textile school of Lowell, Mass. The organization of such a school was proposed in 1891, but not until the results of foreign schools had been thoroughly examined and their value to the textile industry made perfectly apparent, was the Lowell Textile School organized in January, 1897. The establishment of this school was the result of an imperative demand; its presence shows its economic necessity. Its incorporators represent the textile industries of the Merrimac Valley, with a capital of $25,000,000. The New Bedford Textile School will be opened September next.

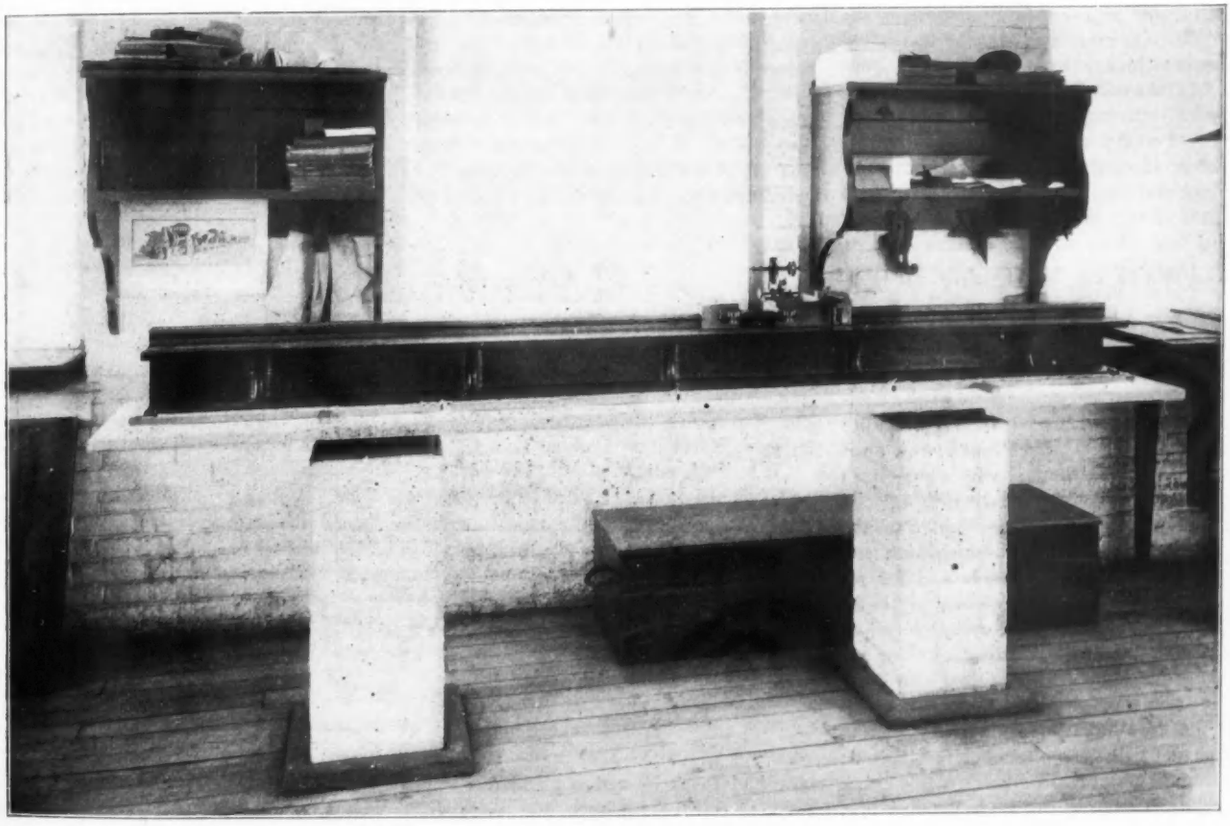

FIG. 27. STANDARD COMPARATOR, SPRINGFIELD ARMORY.

The manual-training idea, first suggested by Victor Della-Vos, Director of the Imperial Technical School of Moscow, in 1866, is being well cared for in the United States, and is being extended constantly. The work done at such schools as the Mechanics Arts High School in Boston, the Rendge Manual Training School at Cambridge, Mass., and the Woodward Manual Training School at St. Louis, compares favorably with work done anywhere. Also intermediate schools, such as Pratt Institute in Brooklyn, Drexel In-

stitute in Philadelphia, and Lewis Institute in Chicago, are exploring a field hitherto untrodden and are profoundly influencing American education for good.

The highest grade of technical education—professional engineering—is well done at many universities like Pennsylvania, Columbia and Wisconsin, and at private institutions like Worcester Polytechnic and Stevens Institute of Technology, while the Massachusetts Institute of Technology and Sibley College of Cornell University may be ranked on a par with Charlottenburg, in Germany, and the Polytechnicum at Zurich, Switzerland.

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The advantage which we in the United States have is three-fold—abundance of raw material and fuel near at hand, superior machinery and an intelligent people. If we could but add the special or technical training of our people, we could then feel confident that in all the elements which go towards assuring success in commercial warfare, we should be superior to any country in the world.

Two Ways of Machining an Engine Frame.

BY B. W. T.

The engine frame to be machined was a 10x12-inch center-crank frame of the agricultural class, Fig. 1, with curved saddles to fit the boiler. The necessary work on it included: Facing the end where the steam cylinder was to be bolted; drilling and reaming the hole *A* in the center of the frame end through which the piston rod passed; boring the packing box *B* for receiving the gland; boring the babbitt holding rings C true with the cylinder end of the frame, and to the proper size for receiving an arbor for babbitting the bearings; facing both ends of the boxes; planing the crosshead guides and the pad to which the valve slide bracket was bolted; drilling and tapping the holes in the crank boxes for receiving the studs for the caps, the holes in the cylinder end for receiving the studs, and finally four holes in the ends of the guides for studs holding the top guides in place.

The first operation under the old method was facing the cylinder end of the frame in an ordinary engine lathe, and boring the piston hole and the packing box. The frame (this size weighed about 800 pounds) was brought on a truck from the foundry and placed near the lathe. This required the services of two men, and consumed considerable time. The frame having to be loaded on the truck without the assistance of crane or air lift, drawn by hand through the sand to the machine shop, and then through the shop to the lathe, meeting with all manner of obstructions, thirty minutes would hardly do the job; thirty minutes for two men, or one hour. To place it on the carriage of the lathe an ordinary chain lift was hooked to an eye-bolt in the floor above, and then by the hand-over-hand process it was pulled up, two men holding it clear of the lathe while the machinist did the hand-blister act. It was placed on pieces bolted to the carriage to receive it, lined up by using iron wedges under the ends of the saddles, and clamped fast. The facing of the end was done by an ordinary facing head bolted to the face-plate of the lathe, two cuts being necessary and a change of tools for squaring the shoulder.

The hole for the piston-rod was drilled with a twist drill in the lathe spindle, the drill removed and a bar, Fig. 2, inserted. This bar had a flange by which it was clamped to the face-plate, thus preventing it from pulling out when the back cuts were made in boring the packing box. A cutter was put in the slot, and the rod hole was bored and then reamed by hand. Next, the cutter was taken out and the carriage run forward until the slot came through the packing box; another cutter was then inserted and the packing box bored, two cuts being made. The truck

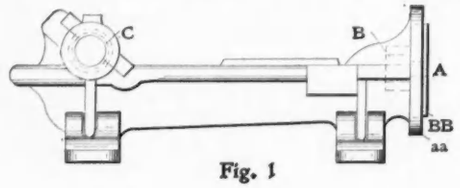

Fig. 1

Fig. 2

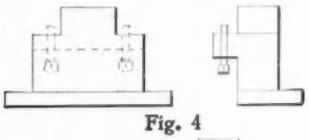
Fig. 4

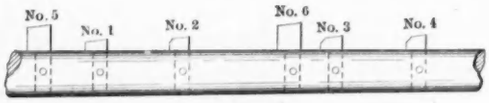

Fig. 3

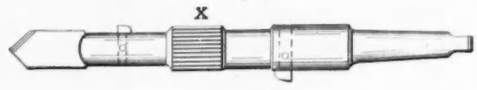

Fig. 5

Fig. 6

MACHINING AN ENGINE FRAME.

for the studs, also four holes in the guides, four in the valve bracket pad and ten in the end of the frame. There were good jigs for all these holes, excepting those in the crank bearings, therefore the only waste of time was in handling the frame and laying out the holes in the bearings. The time under the drill was three hours. This drill-press was a small radial with a pit of sufficient depth to allow the frame to set on end. It was conveniently near the erecting floor, so that little time was lost in moving from the drill to the trestles, although the inevitable chain hoist had to be used.

The babbitt holding rings at the ends of each box were about ¼ inch thick, and enough smaller in diameter than the shaft for chipping to bring the babbitting arbor right.

The frame was set level on the trestles, a straight-edge clamped across the faced end, and the babbitting arbor trammed parallel with it and at the same hight with guides. To do this considerable chipping now had to be hunted up, and the frame was taken to the planer, the same difficulties being met as in bringing it from the foundry. Thus far, five hours were required.

The frame was then placed on the planer by means of a chain lift, and the faced end bolted against an angle-plate with a face a facsimile of the end of the cylinder.

A bolt through the piston-rod hole held the frame in place. This rig was all that could be desired. The only lining-up required was bringing the crank bearings level. The work done by the planer included planing the crosshead guides and the valve bracket pad, also the ends of the crank bearings, both inside and out. Two and a half hours were required for planing the guides and the valve bracket pad; two hours for the crank-shaft bearings and a half an hour for setting and removing the frame, or in all five hours for the planer work.

The next operation was drilling and tapping the holes in the crank-shaft bearings and trying were required, usually taking about one and one-half hours. This practically completed the frame—the entire work being done in fourteen and a half hours.

The other way of doing the work was as follows: The frames were placed by a jib crane air hoist on a tram car in the foundry cleaning room (usually three in a load) and were run into the machine shop and unloaded by an air hoist at the drill where the stud holes in the crank bearings were drilled and tapped, the caps having previously been drilled by a jig, and being now put in place for drilling the holes in the bearings. The delivery of three frames by the foundry man to the drill press took one quarter of an hour; placing one in position and doing the work above mentioned, three-quarters of an hour. Thus but fifty minutes, or in round numbers, one hour had been consumed when the frame was delivered to the horizontal boring mill, by an air hoist and crane.

It will be noticed that in first enumerat-

ing the operations required on the frame mention was made of boring the babbitt holding rings in the crank bearings. This was not done in the first method, therefore the necessity of chipping and filing them in order to line the shaft. We now have a horizontal boring mill in which to do the work done in the lathe, and in addition bore the babbitt rings. We soon found that this mill as built would not make the cuts desired. The proportions of the back gears had to be changed and the countershaft pulleys and pulley on main line increased in size to get strength of drive. A portable boring attachment was designed and built, being driven independently of the mill. This consisted of a platen of sufficient length and width to receive the largest frame, and on this were placed two housings similar to a planer housing, each of which carried a bearing gibbed to it, and which could be moved up and down the housings by screws geared together across the top by a shaft. Fig. 3 represents the boring bar in the boring attachment, which was set at right angles with the bar of the mill. This attachment was rope driven and had hand feed only.

The frame was picked up with the top side down by air hoist or electric crane and placed with the crosshead guides on blocks like Fig. 4. By means of the set screws in these blocks any desired adjustment could be made. When in position the frame was clamped by two heavy open-end clamps with bolts in slots in the platen. The regular facing head on the mill spindle had to be replaced by one of special design, in which roughing cutters could be readily placed and removed, also carrying a scrape-cut tool of proper shape and width to finish the surface *a a* and the circumference of the boss *B B*.

Fig. 5 shows the tool for boring the piston rod hole *A* and the packing box *B*. In the facing head were placed two roughing cutters of mushet steel, one round-nose and the other half-round (see Fig. 6). These were placed 1½ inches radially from center to center. Each of these cutters had 1½ inches of surface to clear of scale, and the half-round one cut the scale from the circumference of the boss *B B*. The scraping cutter was placed with its cutting edge projecting but little beyond the face of the facing head, the roughing cutters projecting beyond it.

The tool represented by Fig. 5 has a drill point 1-16 inch less than the finished size of the piston rod hole. Back of the drill the body of the tool is sufficiently less than the drill for clearance. In this part a cutter is placed with which the drilled hole is trued out. This is followed by a reamer *x*; back of the reamer is clearance, followed by the body of the tool of proper size for a running fit in the reamed hole. In this part of the tool a cutter is placed. The operations then were as follows: The platen carrying the frame was moved forward until the roughing cutters were under the scale, and the star feed was thrown in. While they were making the run of 1½ inches the tool, Fig. 5, was brought to work and the piston rod hole drilled. By the time this was done the roughing cutters had reached the point where the feed must be thrown out, and a few movements of the star were made by hand to rough the boss. The roughing cutters were then removed and the platen moved forward against the scrape cutter, thus finishing the facing. The piston rod hole being drilled, the bar was moved forward and the hole trued out and followed by the reamer. Moving the bar still farther forward, until the slot appeared at the outer end of the packing box, a cutter was placed in it, and a backward feed of the bar thrown in. While this cut was being made the operator stepped forward and started the cross-boring bar. The positions of the cutters in this were such that when No. 1 had finished its work No. 2 began, and the same with Nos. 3 and 4.

Boring the babbitt rings required a travel of about 2 inches, bringing facing cutter No. 5 in position to face the outer end of one bearing, which was done and the cutter removed. Facing cutter No. 6 was then in position to face the inner end of the other bearing, which being done, it also was removed. Cutters Nos. 2 and 4 were now outside of the bearings and were removed, and a facing cutter put in where No. 2 was and the inner end of one bearing was faced. The cutter was then removed and placed in slot No. 4, facing the outer end of the other bearing. Usually the boring and facing of these bearings could not be done without interruption, the operator's attention being given to the tool at work in the packing box; but the complete machining of the frame was done in this tool in one and a half hours. This included placing it in position and removing it.

The frame was then sent to the planer and planed, as described, except that the time (two hours) spent on planing the ends of the crank boxes was saved; and also a gain was made by using the electric crane instead of the truck and chain hoist.

It was sent next to the drill, which was a 60-inch radial. The holes in the guides, valve-bracket pad, and the end of the frame were drilled, the whole taking one and a half hours. From the drill it was sent to the erecting floor and placed on the trestles ready for the babbitt, with but six and a half hours charged against it—a gain of eight hours over the old method.

American Engineers in Europe This Summer.

It has been found that it is impossible to arrange for a sufficient number of members of the American Society of Mechanical Engineers to go to Europe at one time to make it practicable to engage a steamer, and each will go in his own way. From a circular recently issued by the society we learn that:

"On the evening of Thursday, July 5, the president of the Institution of Civil Engineers of Great Britain holds the official reception and conversazione of the Institution in the Guild Hall of the City of London, and the American engineers are invited to be the guests of the Institution on that evening. During the days that precede and follow—perhaps between July 2 and 9—the American engineers are to be the recipients of courtesies from the English hosts, in the way of visits and excursions, which will be arranged for, and it is not unlikely that on Sunday, July 8, there will be services of special interest either at Westminster or elsewhere, which the engineers would enjoy the opportunity to attend. Probably on the Monday or Tuesday following, July 9 or 10, the party will leave London by rail, in special trains *en route* for Paris.

"For those who may find that the necessities of steamer transport compel them to an earlier date, the Institution of Mechanical Engineers of Great Britain arranges to hold its London meeting during the second week of June, which, it will be observed, is some weeks earlier than the date fixed for the other society. The Mechanical Engineers of Great Britain invite the American engineers to take part in their meeting and excursions, receptions, etc., and the date of the gatherings is sufficiently far removed to prevent conflict on the one hand, while leaving a space between the two meetings for the general opportunities of an English visit for those who may be able to spend time enough in London to avail of both opportunities.

"It is also probable that after the trip to Paris arrangements will be made for the further entertainment of American engineers by important bodies in Berlin."

A Co-operative Hospital.

A valuable institution of which all mechanics and other wage earners should be informed is the Emergency Hospital of Boston, which is said to be the only co-operative hospital in the United States, and is supported entirely by wage earners, and its privileges are for those who combine to support it. No donations are solicited, and none are likely to be needed. Cards entitling the holders to free treatment for a year are sold for $1 each. The hospital also has a source of revenue from the sale of drugs, and a small one from the liability companies which in insuring firms against accidents to employees, agree to pay for the first treatment of those injured. During the first four months reported the income of the institution was $21,553, and the expenses were $17,154. The cases treated were: Surgical, 4,404; medical, 6,420; ambulance, 184; ward, 166. Only about four in one hundred require treatment. The wage earners who compose the association have full control over

the hospital through a board of trustees. The doctors are paid a regular salary, and to be eligible they must have passed the regular collegiate course, the medical course, and have had two years' hospital experience.

A Novel and Convenient Blueprinting Gallery.

The blueprint is so important and prominent a factor in modern mechanical engineering that it deserves better provision for its production than is usually provided. The accompanying half-tones tell us that, at last, one firm recognizes the rights of the blueprint, and has taken what may be considered heroic measures to secure them. The rectangular lines of the buildings of the Brown Hoisting and Conveying Machine Company, Cleveland, Ohio, run at almost exactly 45 degrees to the cardinal points of the compass, so that none of the windows of the building give a due southern exposure, and as the demand for blueprints is large and constant, it was determined to provide a printing gallery of sufficient capacity and facing exactly south. This gallery was accordingly built from the fourth story of the office building, in which is the drafting room, to the roof of one of the shops on the opposite side of the roadway in the yard. This gallery runs due east and west, and on the south side there are twelve printing frames which take a sheet 36x24 inches. Larger drawings, when required, are printed in sections not exceeding the above dimensions.

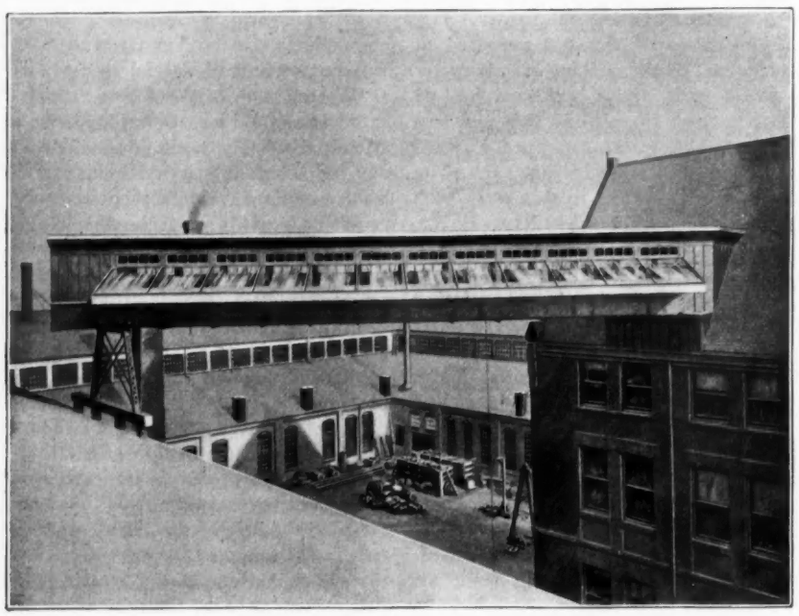

FIG. 1. SOUTH SIDE OF BLUEPRINT GALLERY.

It will be seen by the half-tones that the slanting roof of the printing portion of the gallery is composed of sheets of plate glass much larger than the printing frames and covering the entire spaces between the oblique steel angle beams. This affords a perfect protection from rain, and allows the printing to be carried on in all weathers. The spaces between the large printing frames are used for small tracings, and about fifty prints of the 9 x 12-inch standard size may be made at once. No frames are used for these, merely a pad of blotting paper and then a plate of glass over the tracing, the weight of the glass being sufficient to hold the tracing. Photographs also are, of course, printed here as required.

FIG. 2. INSIDE BLUEPRINT GALLERY, LOOKING WEST.

The construction of the large frames will be understood from Figs. 2 and 3. The wooden frames are balanced in any position by a system of levers and counterweights. These, as well as the iron frames for the glass, are hinged at the outer end, and at the inner end there are springs which relieve the glass from shocks, stop the frame at a certain point and allow the wooden frame to drop away and relieve the tracing. The tracing and blueprint paper are laid upon the carpet-padded surface and the wooden frame is then raised until the glass and the iron frame are reached (see Fig. 2). The two frames are now nearly parallel, and as the motion is continued the entire weight of the glass and its iron frame is thrown upon the tracing. In good light the twelve frames will turn out a print every minute.

There is a case of drawers for blueprints and tracings at the further end of the gallery, and at two points along the length of it are boxes with rolls of blueprint paper, with a cleat and slot at the lower edge for cutting the paper to any length. There is also a large window at the north side, with a hoist outside for raising roll paper and supplies.

The washing and drying room is at the end of the gallery, as shown in the plan Fig. 4. There are two large tanks in one corner of the room, and over these, extending the whole length of one side of the room, are copper wires for drying either freshly prepared paper or the washed blueprints. At the side of the dark room there are racks for filing prints returned from the shops and likely to be called for again; also for duplicate prints. A dumb waiter and speaking tubes, with boys in attendance, connect with the second and third floor drafting offices. Adjoining the gallery and preparing room there is a large dark closet for the use of the photographer, with running water and tank and all needed appliances. In the preparing room there are, of course, large

tables for trimming and sorting prints, and such work. The rooms are all lighted by electricity and heated by hot air. It need not be said that the arrangement is found to be highly satisfactory. The information and illustrations have been furnished us by Mr. Charles H. Wright, chief engineer of the Brown Hoisting and Conveying Machine Company.

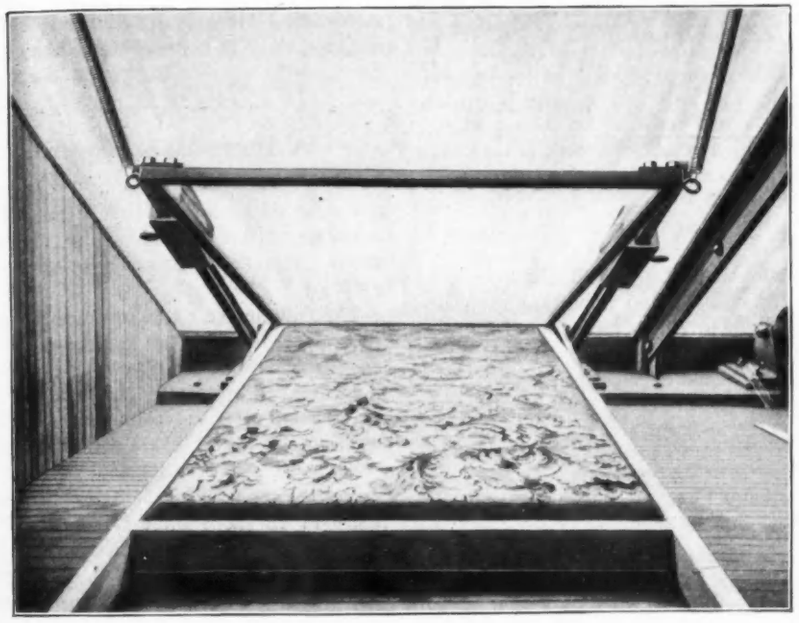

FIG. 3. ONE OF THE PRINTING FRAMES.

Letters from Practical Men

The Primitive Milling Machine—The Mill Hollow Shops at Middletown.

Editor American Machinist:

I noticed in the "American Machinist" of March 8 an article by E. G. Parkhurst, "One of the Earliest Milling Machines," which I read with much interest, as the old shops which he describes are the ones in which I served my apprenticeship at the machinist's trade. I remember the name and date, "J. & R. Johnson, 1827," cut into the coping stone over the basement door of the machine shop. I worked in these buildings from 1873 to 1879 (four years of which I was an apprentice). These premises were at that time occupied by the Stiles & Parker Press Company as a foundry and machine works for the building of presses, drop hammers and special sheet metal working machinery. Several new buildings have been added from time to time to the old original one. The gun shop is still in good condition. I helped to take out the old breast water wheel in 1874, which probably turned the spindle in the milling machine which our friend Parkhurst mentioned in his article. This old wheel was replaced at that time by a modern turbine. More than once was I sent down into the tube of this "new wheel" (as we then called it) to clean out the buckets, which often became clogged with eels and other rubbish. A few years ago while passing through these shops I saw a part of the old original main line shafting still doing its daily duty with as much ease as any modern line could do it. The name "Mill Hollow" still clings to the old place, and the shops are as busy as ever, but are now used for the manufacture of ship chandlery work instead of guns and pistols, as they were back in the forties and fifties. During the sixties, and perhaps earlier, these premises were used for building machine tools. The famous Stroud lathe was made here, a tool which would have been a credit to any builder. During the seventies power presses and all kinds of special machinery for working sheet metal were made in these well-known shops. I think Mr. Parkhurst himself had built many good machines in the old "Mill Hollow" machine shops some years before I was apprenticed there.

Brooklyn, N. Y. F. C. FLADD.

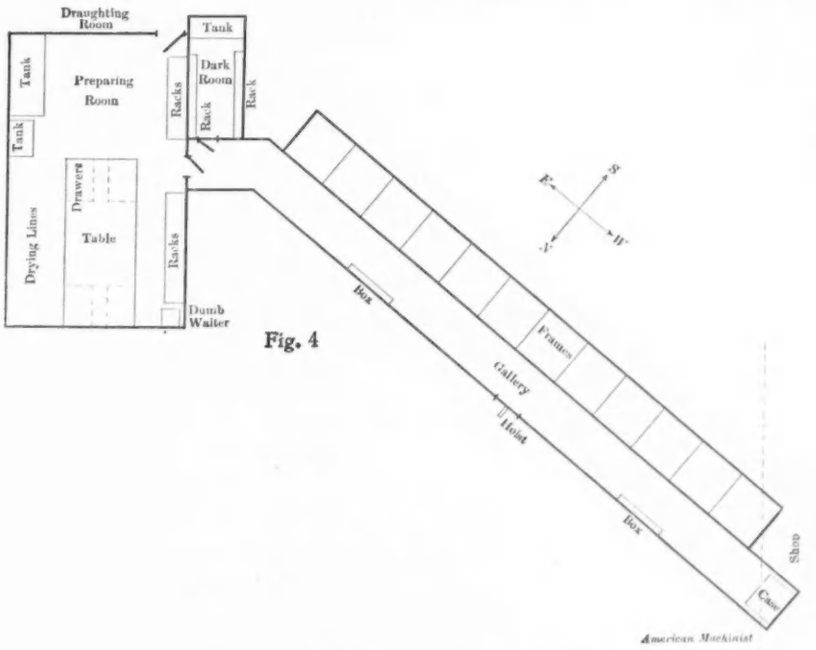

Fig. 4

PLAN OF GALLERY AND BLUEPRINT ROOMS.

The Rights of Shop Inventors.

Editor American Machinist:

"When in doubt lead trumps." There are some questions that are continually recurring and which never seem to be quite settled, and one of these is as to the rights of employers and their workmen to the inventions that have their birth in the shop. This is a case that calls for trumps, and the trump of course is common-sense.

An invention is something assumed to be of value, or it would not call for so much discussion as to its origin and ownership. There are two, or perhaps three, different kinds or classes of inventions. The first is where the new device or arrangement is deliberately sought for and is secured by protracted induction and experiment. Inventions thus produced leave little question as to who is the inventor, and their production can be arranged for and even the remuneration negotiated in advance. There are those who are so constituted or so trained that they are able to design or to devise means or mechanical arrangements for the accomplishment of a given purpose as they may be ordered or requested to do so. It is a simple matter of business to hire a man for this service as for any other, and when there is this preliminary agreement there can be no subsequent question as to the owner-

ship of the invention produced or of the remuneration for its production. This inventing or designing may be the principal service for which the services of a certain man may be engaged, or he may be hired for some other service with a recognition of the fact that some invention may be incidentally involved.

I am personally only enough of an inventor to serve here as an illustration. I was once negotiating, verbally at first, for the superintendency of a factory about to be established for the manufacture of a certain article, and it was proposed by the proprietors that, among other conditions, everything that I should invent while in the employ of the company should be their property, and I agreed to it, considering that this supposed advantage was recognized in the salary to be paid. But when it came to the formal preparation and signing of the papers I insisted that this agreement as to inventions should apply only to those within the legitimate scope of their business. If we had been manufacturing mousetraps and I had invented an improvement on a jewsharp, they would have had no right to it under the agreement. And even on mouse-traps, I having to do only with their precise and economical manufacture, if I had invented another trap or an improvement whereby the same trap was made to catch two mice where it caught but one before, they would have had no right to the improvement if the above agreement had not been made. The United States Patent Office goes invariably upon the assumption that the invention belongs to the inventor, and for anyone to obtain a patent it is only necessary for him to prove that he is the inventor, always assuming, of course, that the invention is novel and useful, and therefore patentable. It is suggested (the suggester in this case is an Englishman) that "the employer may grasp a good thing unprotected from the hands of the workman, attach his own name to the letters patent and give the man merely a nod for his trouble." This is not so easy. The employer to obtain a patent must swear that he is the inventor. If to do it he commits perjury, that is a case that it is not necessary for me to discuss.

A second class of inventions is composed of those which come without conscious and formal seeking, and some of the most valuable inventions have come in this way. Their essential idea has come in the happy thought of a moment, often unheralded and unexpected. These of course cannot be bargained for beforehand, but their ownership is predetermined, for they of course belong to the inventor, and there is no difficulty usually about identifying him and proving his property. If a valuable invention of this class comes to a workman or employee of an establishment, there is no apparent reason why it should not be his property until he has in some way ceded the right to it, and the mere acceptance of employment in the establishment at the regular work of any of the trades could not involve any such cession.

The third class of inventions is more troublesome. These are the joint inventions that grow up in the shop by the aggregation of suggestions from different individuals, and where it is difficult to say who is the real inventor. The initiative in these inventions almost invariably belongs to the establishment. The proprietor sets out to build a new machine. He knows what he wants to do, and has some idea of how it is to be done, but when it comes to making out the details in the drafting room, and also when it comes to the actual construction, better ways of doing things become evident to the draftsman or to the workman, and they usually are not slow in speaking of them, and where they are valuable they are pretty sure to be embodied in the machine, and it undoubtedly happens in many cases that the most novel and important parts of a patentable invention have come from those only incidentally connected with it, but the proprietor or superintendent, or whoever started the thing, usually swears that he is the inventor and gets the entire patent. The status of the draftsman and that of the workman in the shop is of course somewhat different in this case. The draftsman is necessarily also more or less of a designer, and whatever he may possess of the inventive faculty may without much straining be considered as hired with his eyes and his fingers, while the workman may be considered a mere manipulator of materials and his acts of invention are more clearly outside of his legitimate function.

I am not committing myself to the slightest approval of any injustice that may be done to any man by appropriating without credit and without remuneration whatever may come from him of inventive suggestion, but I may say that the actual pecuniary damage is usually not as great as it is estimated. The fact that a prosperous firm may secure profit from an improvement upon some article or machine in their established line does not by any means imply that the same thing would be of the same value, or of any value, to an isolated individual. The whole experience of the traditional poor inventor attests the fact that the ability to market an invention of intrinsic value is a most essential part, and the rarest part, of successful mechanical invention. The appropriating of the suggestions of workmen without acknowledgment is decidedly not the way to get the most out of them, and any establishment that pursues such a course is necessarily handicapped in the business race, because it does not and cannot develop all the improvements that become successively possible.

The practice of the National Cash Register Company in this matter seems to be as near right as the thing can be in actual practice. In the factory of that company every employee is looked upon and treated as a possible inventor. All are encouraged to invent and improve wherever they see a chance to, in any detail of design or construction or elsewhere, prizes are regularly awarded for improvements or suggestions, and none of this interferes with the man's right to patent any invention that is patentable. When a patent is obtained it is bought by the company at a price mutually agreed upon. This is not to be characterized as a *liberal* course, as is commonly done, but it is pre-eminently a just one, and there is nothing higher than justice. TECUMSEH SWIFT.

A Home-Made Planer.

Editor American Machinist:

The need of a large planer is one of the most imperative in nearly all machine shops, yet there is probably no tool less used.

The investment of $2,500 or more for such a tool is more than any but the large shops can afford, considering the limited use of it; hence many of the medium shops are driven to buy second-hand tools of usually the worst character, and once stuck with such ramshackle goods, they rarely if ever recover their financial footing. In all shops there is an occasional dull season that can be utilized in building such tools as are most needed. These can be made at surprisingly low cost, if the proper energy is put into them. I refer to the larger tools, such as a large planer or boring mill or any special tool. It is not necessary to give them the glittering finish found on the fine up-to-date tools, but only absolute rigidity and correctness. Cast gears from existing patterns may be used to advantage for large machines.

It would not pay any shop to make its own small tools. Our company contemplates building a 4-foot planer, the design of which involves only three wheels and a rack, besides the ordinary shifting pulleys, etc. This is about as simple as the big lathe described by Chordal, which comprised "a few gears and a belt and a hole in the ground." This planer will be of the ordinary style with rack and bull wheel.

A large, substantial worm gear of the Hindley or Albro-Clem variety is to be placed on the same shaft as the bull wheel, far enough from the side of the machine to make room for the workman. The pulleys will of course be parallel with the machine and the shop. It is optional to place the worm on top or bottom. The side planing device described in the "American Machinist," February 8, will be attached.

It is not necessary to describe the plan further, for every machinist is familiar with planers, and everyone has his own ideas of rigidity and close fitting. But I would recommend plain finish, for the finest machine will soon get black in ordinary practice. C. W. CRAWFORD.

Brazil, Ind.

Laying Out Angles.

Editor American Machinist:

In the description of a "precision drawing board" in the "American Machinist" for January 11, the question of accurate setting-out of angles was raised. For this purpose the following method is deserving of wider familiarity than it now appears to possess:

In Fig. 1 let $A\ B$ be the given straight line. At point A it is required to set off angle α.

In beam-compasses take .5 of any unit

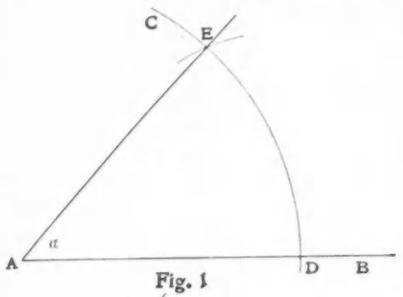

Fig. 1

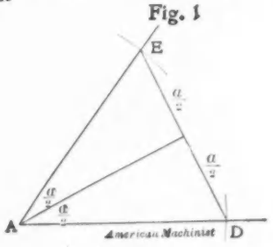

Fig. 2

LAYING OUT ANGLES.

of measurement as radius and describe arc $C\ D$, cutting $A\ B$ at D. From a table of natural sines find sin. $\frac{\alpha}{2}$ (*i. e.* sine of half the required angle). With this, in same units, as radius, and D as center, describe an arc cutting $C\ D$ at E. Join $A\ E$, and $E\ A\ B$ is the angle required.

Proof.—In Fig. 2 let $E\ D = a$. Then $\frac{a}{2} \div A\ E = \text{sin.}\ \frac{\alpha}{2}$. But if $A\ E$ be made equal to .5 or ½,

$$\text{sin.}\ \frac{\alpha}{2} = \frac{a}{2} \times \frac{2}{1} = a$$

That is, when $A\ E = ½$, $E\ D =$ the sine of half the required angle, $E\ A\ D$.

Of course the figures for the two radii can be multiplied by a constant to make them convenient on the scale that happens to be at hand.

The great possible accuracy attainable is vouched for by the fact that the method is used by surveyors in plotting the main angle lines of a survey as taken by the theodolite.

F. O. HUNT.

Manchester, England.

That Clutch Milling Problem.

Editor American Machinist:

The following is, I believe, a solution to Mr. Smith's interesting milling problem in your issue of February 1.

It will be easier to describe and understand, I believe, if we take some specific dimensions for the clutch piece to be milled, and therefore we will say that it is 2 inches in diameter and 2 inches long, with sixteen teeth cut ¼ inch deep and a hole in the center ¾ inch in diameter. Fig. 1 is a plan, showing also two planes $X\ X$ and $Y\ Y$, which cut through the piece. Fig. 2 shows the angle $A\ C\ D$ made by the cutter on the plane $Y\ Y$, and the angle $A\ C\ B$ on the plane $X\ X$. Fig. 3 shows the manner of milling the teeth to obtain the correct shape, as at $S\ S\ S$, after having first milled them in the usual way at the lesser angle $A\ C\ B$, as shown at $R\ R\ R$. The piece is supposed to be held in a suitable fixture and fed towards the cutter, and at the same time rotated at the proper rate about the axis C.

Fig. 4 shows a cheap fixture for holding the piece, made from a chunk of cast iron from under the bench and turned down on one end to go into the jaws of the chuck on the spiral head, the other end receiving the center of the tailstock. A hole is bored near the middle somewhere, and on a line with the centers, to fit the outside diameter of the piece, and a set screw with a piece of brass ahead of it put in one side to clamp it. A narrow deep slot is milled with the back side on a line with the centers, and an indexing finger M fitted to it. The teeth, which have been already milled, as shown at $R\ R\ R$, Fig. 3, are consecutively brought against the part M and clamped. A stop piece O is provided at the right depth, so that the point C will come on a line with the centers.

Having made our "dingus," we are now ready to find the proper gearing to produce the correct difference between the angles $A\ C\ B$ and $A\ C\ D$. In the case above cited, there being sixteen teeth, the line $A\ D$, Fig. 1, is the sine of 22½°, and the line $E\ D$ being 1", $A\ D = .3827"$. The line $E\ A'$ being .375", the tangent of 22½° $= \frac{A'\ B}{.375} = .41421$, or $A'\ B = .375 \times .41421 = .1553$; that is, the line $A'\ B = .1553$. Looking at Fig. 2, the line $A\ C$ is ¼", and in the triangle $A\ C\ D$ we have found $A\ D = .3827"$. Then $\frac{A\ D}{A\ C} =$ tangent angle $A\ C\ D$, or $\frac{.3827}{.25} = 1.551 =$ tangent of 57° 11′. Then the angle $A\ C\ D = 57°\ 11'$.

In the triangle $A\ C\ B$ we have found $A\ B = .1553$, then $\frac{A\ B}{A\ C} =$ tangent of angle $A\ C\ B$, or $\frac{.1553}{.25} = .6212 =$ tangent 31° 51′. Then the angle $A\ C\ B$ is 31° 51′, and this is the angle which our bevel cutter must be made and the clutch first milled out to at $R\ R\ R$, Fig. 3.

To finish the teeth as at $S\ S\ S$, Fig. 3, while the cutter is feeding towards the center E, a distance $A\ A'$, the work must

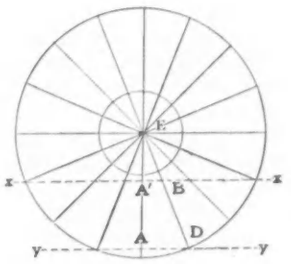

Fig. 1

Fig. 2

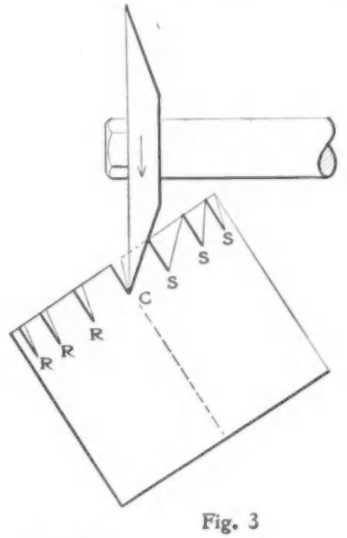

Fig. 3

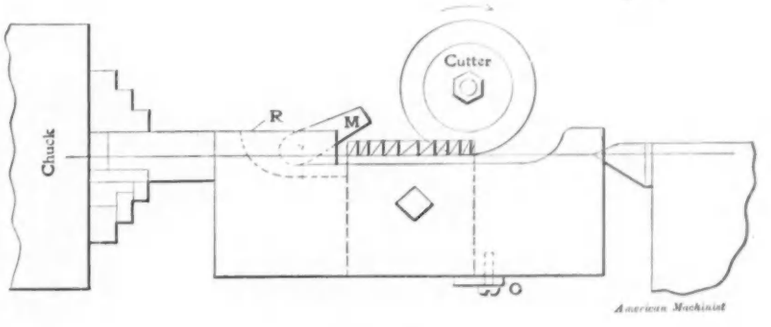

Fig. 4

A CLUTCH MILLING PROBLEM.

be revolved about the axial line C, the difference between the angles—57° 11′ and 31° 51′, which is 25° 20′, or 1,520′. As there are 21,600′ in a complete circle, it turns through $\frac{1520}{21600}$ of one revolution, or .0703. To find the distance $A'A$, Fig. 1, consider the triangle $A\,E\,D$, of which we know $E\,D = 1''$, and the angle $A\,E\,D = 22\frac{1}{2}°$. Then the cosine of angle $A\,E\,D = \frac{A\,E}{E\,D}$, or $.92388 = \frac{A\,E}{1''}$. Then $A\,E = .924$, and as $A'\,E = .375''$, why $.924 - .375'' = .549''$. Then $A\,A' = .549''$.

Now then, while the cutter is feeding a distance of .549″ the spiral head must turn .070 of a revolution, and if it feeds .549″ in .070 of a revolution, in one revolution it will feed as many inches as .070 is contained in .549″, which is 7.83″.

We find on looking at our milling machine table that we have gears which will feed 7.62″ inches to one turn, and that will probably be near enough for a clutch of this character.

RALPH C. SIMMONS.

[It seems to be proper to place the above proposed solution before our readers, with the remark that it evidently is not theoretically correct, and not even as "near enough" as our correspondent suggests at the end of his letter. At the axis E of the clutch the angle must be zero, and at $A\,B$, or at radius .375″, the angle is 37° 51′ (37.85°), then at 1″ radius, or at the circumference of the clutch, the angle, with a constant twist, would be $.375 : 1 :: 37.85 : 100.93° = 100°\ 56'$, which is impossible, because we know that if the radius was extended indefinitely the angle could not quite reach 90°. The bevel face of the cut is a "gain" twist from the periphery inward, and cannot be cut correctly by any train of gears on the usual spiral milling attachment.—Ed.]

A Rig for Trying or Centering Forgings.

Editor American Machinist:

This is a wrinkle that everybody may not know, and I find it very convenient for finding out whether a shaft will true up to size before centering it; also for finding the true center. It is used on all sizes, from small motor shafts up to propeller shaft forgings 25 feet long.

Get the carpenter to saw out two pieces of 2x4-inch pine 24 inches long. Have him saw three slits in each piece, as in the sketch. Have them square and fairly accurate; get a few yards of twine, a scriber flattened at one end like a knife-blade, and a 2-foot rule, and your outfit is complete. Now, take your shaft, place it across a pair of horses, chalk the ends for centering, and place one of the sticks across each end, leaning an old bolt, or other suitable piece, against each one to hold it there. Knot one end of your twine and string it through the outer slots in the 2x4 inches along the sides of the forging; stretch tight and tie (it takes two to work this, one at each end of the forging), then center the sticks by the strings at each end. When all is ready proceed as follows: Take one-half the given diameter and subtract it from 6 inches, which will give you the distance from the finished surface of the shaft to the string. It is evident that the actual distance to the string as measured from the forging must be less than this, or the shaft will not true up. The difference between such smaller measurement and the distance to the finished surface as previously found will be the amount of stock on the side measured. Having got your sticks in such a position that your rule indicates that it will true up all the way along both sides, take the flattened scriber and scratch a line in the center slot of the sticks. Take them off and give the shaft a quarter turn, repeat the operation and your center will be at the intersection of the two scribed lines. This method is very simple when once learned, and is in constant use at the Duquesne Forge, Rankin Station, Pa., we having used it on forgings for shafts having as high as thirteen different diameters.

E. J. H.

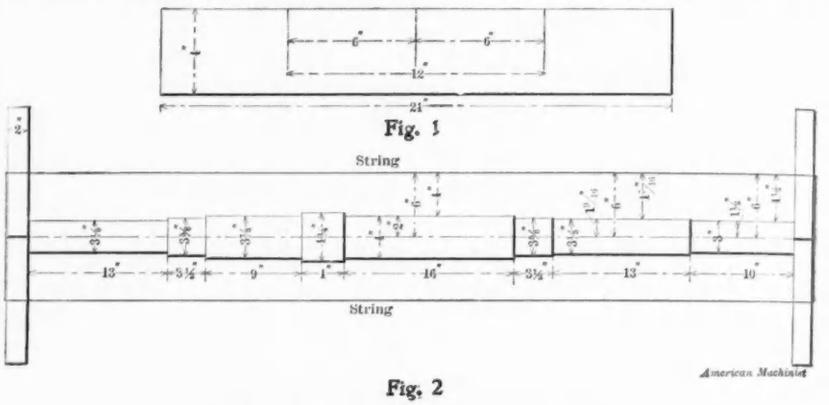

Fig. 1

Fig. 2

RIG FOR TRYING OR CENTERING FORGINGS.

Soap for Tracings that Have Been Scraped.

Editor American Machinist:

I was well pleased with the results of using a piece of wax from a phonograph record cylinder for restoring the surface of tracing cloth, etc., as mentioned by Mr. Russell T. Kingsford, in the "American Machinist" of February 22, and which I found, after trial, to be preferable to soapstone, which I had heretofore used for the purpose; but Mr. Kingsford's suggestion gave me a hint which I followed up by some experiments by which I arrived at, I think, good results, and by a method that might be more convenient to many of your readers who might not have discarded record cylinders at hand.

That you may be better able to judge of the results of my experiments, I enclose a small sample of tracing cloth, on which I first drew the circle and then with a sharp knife thoroughly scraped the entire surface within the circle. I think you will agree with me, after inspecting it, that the surface was thoroughly scraped. I then rubbed it with (could anything be more cheap and handy!) a piece of white soap, and then drew the ink lines over it.

I leave you to judge the results, and how well it answered the purpose.

The soap that happened to be at hand, and which I used on enclosed sample, was the kind known as "Ivory," and you have probably heard that "it floats"; but I presume almost any other kind would answer the same purpose.

E. C. SLATER,
Deputy City Engineer.

Erie, Pa.

[The tracing inclosed by Mr. Slater bears evidence of having been thoroughly scraped within the circle referred to, and lines passing through the circle, whether heavy or light, show no difference whatever between the scraped and unscraped portion. The soap, however, does not, of course, make a waterproof coating, as the record wax is claimed to do.—Ed.]

A Pattern Maker in the Drafting Room.

Editor American Machinist:

Noticing D. E. MacCarthy's article in the "American Machinist," March 8, on "A Tool Maker in the Drafting Room," I thought that a few words on "A Pattern Maker in the Drawing Room" might not come amiss.

While there are a great many competent draftsmen who have gone through the machine shop, the reader knows that few of them can be found who really understand pattern making. How often it happens that a draftsman will put in a rib here or there, when it could be put in at another place just as well and result in a saving of time in the pattern shop and foundry. Why would it not be an advantage to large manufacturers to employ an A 1 pattern maker as part of their drawing force? He could examine each drawing before it is traced and suggest such small changes as necessary without altering the general design of the machine, and

thus save time in the pattern shop and foundry. C. C. R.

[This same argument might be applied to the foundryman and also to the man who is to use the machine, and it is largely knowledge of what will facilitate the work of those who are to build a machine that makes a good designer. Where the draftsman lacks shop experience this deficiency should, of course, be compensated for as far as possible by frequent consultations with those who are to have charge of the work, or, as suggested, by having at hand someone with practical shop experience. —Ed.]

Ground Joints—The 4-Jawed Chuck

Editor American Machinist:

I notice in your issue of March 1 an article on unground joints, by E. J. Armstrong. I wish Mr. Armstrong would enlighten us further by telling us how narrow he leaves the bearing—say, between a 20-inch cylinder and its heads.

It has been my practice for years to use quite narrow surfaces for grinding—not over ½ inch in above instance—but I do not recall trying them unground or without packing.

I do not quite agree with Mr. Armstrong, that it does no (or very little) good to publish shop "kinks." Probably no one knows how many are appropriated and nothing said about it. I, for one, have been benefited many times by reading these shop items.

I would like to ask the readers of the "American Machinist" why it is that the workmen so generally prefer the independent four-jaw lathe chuck to the universal three-jawed; or *do* they generally prefer the four-jaw or not? E. S. Newton.

An Incorrect Reducing Gear.

Editor American Machinist:

In your issue of March 1 there appeared an account of a new indicator reducing motion which was vouched for by the author as simple, cheap, neat, easily handled and capable of giving a perfect diagram. While I admit its many advantages for application to engines of the enclosed box-frame type, and that it is an ingenious device, I cannot admit its author's claim for accuracy.

With the desire only of making it complete and all that he claims it to be, I wish to call attention to the slight changes necessary to make it accurate. Referring to his sketch, why was the shaft K located as shown? It is evident that this arrangement will not give a perfect diagram, and it requires but a few minutes with pencil and paper to prove the error. However, this error is confined to one end of the diagram, being over 25 per cent. at one-twelfth stroke, and 12 per cent. at one-third stroke from that end, diminishing gradually to the other end, and may be very nearly eliminated by changing the location of the center of the shaft K. If this center is so located that a horizontal line through K bisects the angle of vibration of the arm $K\ A$, and the cord is perpendicular to the arm $D\ K$ when in the center of its travel, instead of the latter being set arbitrarily at right angles to arm $A\ K$, the motion of the indicator drum will be reasonably accurate. As at least one of these arms must be made separate from the shaft, the matter of adjusting the angles is simple, and the only additional change is the point of attachment of the spring H to the engine frame. S.

Tinning Process—Lining for Vitriol Tanks.

Editor American Machinist:

After a number of years' experience with vitriol tanks I would say that I thoroughly agree with your correspondent, Mr. Entriken (in your issue of March 8), that a zinc lining for such a tank is altogether unfitted, as is also a lead lining with its joints soldered. For this purpose a quality of lead known as chemical lead should be used, and the lining should be fitted in the tank by an expert lead burner.

As lead linings are apt to wear rapidly where heavy articles are thrown into the tank, I have found it good economy to place inside of the lead an extra lining of hard wood, such as oak. It is true that the acid will attack this wood, but the saving resulting—which greatly lengthens the life of the lead lining, to say nothing of the saving in repairs—will more than balance the expense of the more frequent renewals of the wooden linings.

New York. Albert A. Cary.

The Machinists' Strike.

At this writing it seems likely that the machinery interests of the country will pass through a struggle between employers and men which will be far more serious than any that has preceded it in this country. In Chicago a committee of the National Metal Trades Association, which tried to bring about a settlement of the difficulty, failed to do so, because the proposition they made for arbitration was declined by the representatives of the International Association of Machinists. The proposition made is as follows:

"The parties hereto, believing in the principle of national arbitration in settling contentions that arise between employers and their employees instead of resorting to lockouts and strikes, do hereby recommend for ratification by the two organizations known as the National Metal Trades Association and the International Association of Machinists, the following joint agreement:

"*Whereas,* The past experience of the National Metal Trades Association and the International Association of Machinists justifies the opinion that mutual agreements conducing to greater harmony in their relations as employers and employees will be of advantage; therefore

"*Resolved,* That this committee of conference indorse the principle of national arbitration in the settlement of trade disputes, and recommend the same for adoption by the members of the National Metal Trades Association and the International Association of Machinists. Be it further

"*Resolved,* That in all pending disputes and disputes hereafter to arise between members of the respective organizations—*i. e.,* an employer and his employee or employees, every reasonable effort shall be made by the said parties to effect a satisfactory adjustment of the difficulty, failing in which either party shall have the right to ask its reference to a committee of arbitration, which shall consist of the presidents of the National Metal Trades Association and of the International Association of Machinists, or their representatives; and two other representatives from each association appointed by the respective presidents. The finding of this committee of arbitration by a majority vote shall be considered final as regards the case at issue, and as marking a precedent for the future action of the respective organizations. Pending adjudication by the committee of arbitration there shall be no cessation of work at the instance of either party to the dispute. The committee of arbitration shall meet within two weeks after the reference of the dispute to them.

"This agreement shall take effect from the date of its ratification by the said two associations, notice of which ratification shall be promptly given to each other by the respective secretaries.

"And it is further agreed that during the time necessary for the ratification hereof as above provided, and the time needed to consider and act upon the above proposed joint agreement, there shall be no lockout or strikes in either association; and all lockouts or strikes that now exist and are participated in by the members of either of the parties to this agreement shall be immediately and officially called off, wherever they may exist."

We personally know that some of the members of the committee have always shown a disposition to be fair and considerate in their dealings with their men, and have even gone out of their way to benefit them. It is probable that the entire committee hoped their proposition would be accepted, and that it would lead to a settlement of the difficulty. In fact, the resolutions as given above are substantially as they were written out by H. W. Hoyt, the secretary and general manager of the Gates Iron Works, and agreed to by Mr. O'Connell, president of the International Association of Machinists, before the joint conference was called, Mr. O'Connell stating that he believed in the principle of arbitration, and had no doubt that a satisfactory settlement of the whole difficulty could be arrived at upon the lines laid down by the resolutions. Finally, however, it was found that O'Connell "could not deliver the goods," so to

speak, National Organizer Reed, of the I. A. M., offering and insisting upon an amendment requiring that the present difficulty in Chicago should be settled first and before the men returned to work. This the administrative council of the M. T. A. would not agree to, insisting that the strike had been precipitated by the I. A. M. without notice and without a chance for conference or amicable settlement, and that the questions at issue could be settled only upon broad lines and in such a manner as to secure the indorsement and support of the entire membership of the M. T. A., which has members owning shops all over the country.

Mr. Hoyt is vice-president of the National Founders' Association, and in that capacity has during the past six months taken a prominent part in the settlement of a good many questions that have arisen between members of that association and the molders' organization, of which Martin Fox is the official head. He expresses the belief that it is possible to settle without serious difficulty any question that may arise between employers and men, where both sides are willing to be reasonable and fair. He does not believe that all the right is on one side, freely admits that many of the difficulties that have arisen have been due to the fact that too many employers have been heedless of their relations with their men and too imperious with them, says these difficulties can only be smoothed over by mutual conferences based upon the principle of "live and let live," and that employers, owing to their greater opportunities, their usually broader horizon and greater power, should go more than half-way, if necessary, in efforts to bring about amicable and mutually satisfactory relations. He freely admits that he himself has been broadened and has been enabled to take a more liberal and a fairer view of these matters as a result of his work as an officer of the National Founders' Association, and says that he knows other manufacturers have had the same experience; giving instances of shop proprietors who, a short time ago, could not hear the words "trade union" mentioned without imminent danger of lapsing into profanity, but who, as a result of experience in the settlement of difficulties through the medium of these organizations, have come to see that in this, as in most other things, there are two sides to the matter and that, managed upon a reasonable basis and with a disposition to make mutual concessions if need be, less trouble may be experienced than when neither side or only one side has an organization, and affairs are allowed to drift as they may.

There can, we think, be no doubt of Mr. Hoyt's entire sincerity and desire to see the trouble settled upon liberal lines; at the same time he believes the M. T. A. is entirely right in refusing to attempt to settle the local difficulty in Chicago by the action of an organization representing the entire industry, and thinks the men will eventually perceive that in refusing to return to work pending a settlement of the whole question upon broad and national lines they made a serious mistake.

At the breaking up of the conference it was understood that the administrative council of the M. T. A. stands ready at any time to again take up the question whenever the I. M. A. is ready to do so, both sides to stop all fighting in the form of lockouts, strikes, etc., pending a decision or agreement. The latest news from Chicago is to the effect that the men and their employers are in some cases settling their difficulties, or at least coming sufficiently near to an agreement to resume work for the present, this being done independently of the general organizations on either side. If this movement goes far enough it will, of course, open the way to a general settlement of the points in dispute, which settlement will apply to all shops and men belonging to the respective organizations.

In insisting upon a resumption of work in all shops where strikes or lockouts have occurred pending the decision of a joint conference, representatives of the Metal Trades Association proposed to follow the plan which, as we have before pointed out, has worked and is working well in the case of two organizations of foundrymen. It has always been our belief that when either side to a labor dispute offers to arbitrate it is the duty of the other side to accept the offer if it can possibly be done, and it nearly always can be.

In Cleveland the men seem to demand nothing more than a nine-hour day with ten-hours' pay; but in Chicago the principal demand is the "recognition of the union;" *i. e.*, a promise on the part of employers not to employ any but union men. At page 149 we gave an outline of a form of trade union that has been successful in England, and which involves an agreement of that kind. But in that case employers derive a benefit from such agreement because it is a reciprocal one; that is to say, the men also promise not to work for any employer outside of the union, and to discipline any member who does so. No employer can be expected to sign a one-sided agreement of this kind unless compelled to do so, and whether or not the machinists' organization is strong enough to do the compelling seems likely to be settled within a short time.

Machinists—employing and employed—have always prided themselves upon the high degree of intelligence required of those who construct, sell and manage machinery. It seems a pity that this intelligence cannot be brought to bear upon the settlement of such difficulties as may arise respecting the terms of employment; we believe it can be, but never by each side remaining to itself and calling names. There are some men on both sides who seem to think that if they only call names hard enough and keep it up long enough, the trouble will end in their triumph. We hope the men who have better control of themselves and who are willing to apply their intelligence to these questions and to reason together will be able to settle the matter with the least possible disturbance of business and of friendly relations.

A Statement by an Officer of the I. A. M.

The views of the leaders of the I. A. M. and their probable plan of action were stated by John J. Connolly, organizer of the association and member of the general board of trustees, who was in Cincinnati several days last week and was interviewed on the situation. To a "Commercial Tribune" reporter Mr. Connolly made the following statement, which is vouched for as authentic:

"My organization is very jealous of the autonomy of its unions, and the question of strike or no strike rests almost entirely with them. If the conditions of the trade are satisfactory to the lodges, that is their business. For instance, the lodges in Cincinnati, if they see proper, may make an agreement with local manufacturers for, say, ten hours at twenty-five cents an hour, at the very minute that lodges in other cities are striking for nine hours at twenty-eight cents an hour. When once, however, the lodges of any particular city have made a demand all the resources of the national body are at their command in enforcing it. But should it happen, for example, that the manufacturers of Cincinnati would now do any work or have any done by or for manufacturers in Chicago or Columbus, which are at present under the ban of the organizations, at that moment the national body would have the right to order every man in this city out, and I may say that if anything of the kind is done, that will be the procedure.

"The existing trouble at Chicago in its inception and its essence is purely a local one, and it is in this light that we have tried to treat it, but the manufacturers' committee in discussions over a general agreement persistently drag it in. Now, this trouble about which so much is said was caused not by the men, but by their employers. The men have never refused to arbitrate, but, on the contrary, have done all in their power to secure it, and only last week had a long conference with the employers, in which they were urged to submit matters to arbitration, only to meet with failure. If there be trouble, then it is not to be laid at the door of the men, but is to be placed with the employers. We feel that our cause is a just and reasonable one, and are willing to leave it to the judgment of any fair and impartial tribunal.

"Of the manufacturers in Chicago there are not above eighteen who are members of the National Metal Trades Association, so that it would seem that they could not

rightly claim much consideration at the hands of that organization. The agreement we seek to have accepted was originally drafted by the N. M. T. A. There was one clause in it, however, which provided that all existing lockouts or strikes should be called off pending its submission to the various manufacturers throughout the country. For the words 'called off' we substituted 'arbitrated,' and with this amendment we have given the manufacturers until April 1 to accept the agreement. In short, we want to arbitrate all difficulties.

"We know nothing of what is popularly called a 'sympathetic strike.' Before a lodge can strike it must first present a demand for the correction of local grievances that are refused. If it should strike merely for the purpose of antagonizing the manufacturers, its charter would be revoked instantly. Then, as I have intimated, the national body may order a strike when the manufacturers of one place have business transactions with manufacturers whose men are on a strike, so that a strike can become national when a tie-up is made of every manufacturer now involved in trouble. Never in the history of our organization was it in a better position, not alone in the unity and number of its members, but also in the excellent condition of its treasury, to wage a successful fight, than at present. Every lodge has a big contingent fund, while the national funds are very large, so that, though our resources are not unlimited, they are still sufficient to warrant the assertion that we can put up a good stiff contest."

Consul at Chemnitz Resigns.

J. C. Monaghan, United States consul at Chemnitz, has tendered his resignation. Mr. Monaghan has accepted the editorship of a leading industrial publication in the United States, having specially in view the promotion of industrial technical education. Mr. Monaghan has been an exceptionally conscientious, painstaking and able consul, and our consular service sustains a decided loss by his resignation.

Personal.

Our contributor, R. H. Palmer, has taken charge of the foundry of Clark Brothers, at Belmont, N. Y.

D. W. Pedrick, formerly of the Pedrick & Ayer Company, has now supervision of the tool department of the L. B. Flanders Machine Works, H. B. Underwood & Co., Philadelphia.

A. F. Hemingway, formerly with the Western Electric Company, Chicago, Ill., has accepted a position as designer in the detail department of the Westinghouse Electric and Manufacturing Company, at East Pittsburgh, Pa.

Charles Zabel, since 1892 employed as a draftsman at the plant of the General Electric Company, Schenectady, N. Y., has entered the mechanical engineering department of the Westinghouse Electric Company, at East Pittsburgh, Pa.

Albert C Sawyer, for the past five years tool maker with the Goodyear Shoe Machinery Company, Boston, Mass., has taken a position as foreman in the detail department, Westinghouse Electric and Manufacturing Company, at East Pittsburgh, Pa.

Obituary.

James Graham, of the firm of James Graham & Co., West Haven, Conn., died March 19, sixty-five years old.

Andrew Bolter, of the foundry firm of A. Bolter & Sons, Chicago, died March 17, eighty years old. He was born in Germany, and came to this country in 1856.

Robert T. Deakin, a manufacturer of small articles of brass, died in Philadelphia March 22, sixty-two years old. He was born in Sheffield, England, where he learned his trade, and came to this country in 1868.

George Yule, inventor and manufacturer of hat-making machinery, died March 18 at Newark, N. J., fifty-eight years old. He was a native of France, but of English parentage, and came to this country when about twenty years of age.

Walter Nishwitz, proprietor of an agricultural machine works at Millington, N. J., died a few days ago, seventy years old. About a quarter of a century ago he sold a mowing machine patent to the Walter A. Wood Company for $100,000, and shortly after patented a harrow and built the works at Millington.

George B. Sennett, president of the George B. Sennett Company, Youngstown, Ohio, died March 18, sixty years old. His father was a pioneer foundryman of western Pennsylvania. In 1865 he engaged in the building of oil machinery at Meadville, Pa. The works were removed to Youngstown in 1896. Mr. Sennett was a man of liberal education, and he was known all over the scientific world as an ornithologist.

William S. Doig, inventor and manufacturer of box-nailing machinery, died in Brooklyn March 20, fifty-two years old. Mr. Doig served a five-years' apprenticeship as a machinist at the Novelty Iron Works, in this city, getting out of his time in 1869, and the certificate of the firm, signed by Horatio Allen, was conspicuously displayed in his office. He worked a few years at his trade, and in 1878 the firm of Smith & Doig was established. He became sole proprietor in 1885, and from a general machine business the shop later became almost entirely a manufactory of his box-nailing machinery. A considerable display of this machinery has been arranged and shipped for the Paris Exposition.

Stephen P. M. Tasker died in Philadelphia March 19, sixty-five years old. Mr. Tasker was a son of Thomas T. Tasker, one of the original members of the well-known firm of Morris & Tasker, who died a few years ago at the age of ninety-three. The son entered the pattern shop and drafting department of the works, and at the age of twenty-one became a member of the firm, retaining his connection until the sale of the works in 1899. The works, which originally occupied a solid square in the heart of Philadelphia, were subsequently removed to New Castle, Del., where the plant was constructed under the supervision of Mr. Tasker. Several important inventions were perfected by him. At the time of his death Mr. Tasker was engaged in the cold storage business.

Legal Notes—Accident With Scrap Iron Shears—Falling Door—Clothing Caught in Cogs.

BY W. M. SEABURY.

The case of Joseph Glover against the Kansas City Nut & Bolt Company was recently decided by the Supreme Court of Missouri.

The plaintiff, who was a boy of fourteen years of age was employed by the defendant as a helper to the operator of shears used for cutting scrap iron previous to its manufacture into nuts and bolts. It was the plaintiff's duty to take pieces of scrap iron from the pile near the machine and place them within reach of the operator of the machine and to remove the pieces into which the iron had been cut by the machine.

About two seconds before the accident occurred, the operator passed between the plaintiff and the machine, and, with his back to the plaintiff, immediately took hold of the lever, started the machine, and with the first descent of the upper blade of the shears the plaintiff's thumb and three fingers of his left hand were cut off.

He brought suit against the company to recover damages, alleging in his petition, among other things, that the defendant's operator had been negligent in starting the machine without giving the plaintiff notice of his intention of doing so. The trial court rendered a judgment for the plaintiff. The defendant appealed and secured a reversal of the judgment, the plaintiff, in the estimation of the Appellate Court, having failed to show any negligence on the part of the defendant.

The plaintiff also failed to account satisfactorily for the presence of his hand upon the blade of the shears. It was shown by the defendant that it was not part of his duty to put his hands upon the machine, and the court therefore refused to hold the defendant liable. (55 S. W. R. 88.)

The Supreme Court of Appeals of Virginia recently reversed a judgment rendered in favor of one Green, in an action brought by him against the Riverside Cotton Mills to recover damages for injuries

sustained by him while in the employ of this company

It was Green's duty to clean the dust and cotton off of the card machines.

Upon one occasion, while wiping off the dust and cotton from a door in the side of the casing covering one of the machines, this door fell out, causing Green's hand to be thrust through the opening into the case, and caught and mutilated by the cylinder revolving therein.

Green contended that the mode of fastening this door was defective and insecure and that the defendant company was guilty of negligence in not providing for keeping the door in its place.

The door in question did not work on hinges, and was not intended to do so. It was put in place by being slipped up and behind two outer lips or projections at the top of the opening, and held in place at the bottom by a cast-iron button, 3 inches long, and turned easily on a cast-iron bolt or screw.

It was shown that this button was a secure and certain fastening, and that, when in position, the door could not be removed, except by turning the button from a vertical to a horizontal position, and that this change could not be accomplished except by some human agency, either accidental or designed.

There was no explanation wh tever of how the accident occurred or why the door fell out, and the Court held that even if the fastening to the door was defective and unsafe, still the plaintiff could not recover, because the defect relied on was open, obvious and as well known to the plaintiff as it could possibly have been to the defendant. (34 S. E. R. 965.)

CLOTHING CAUGHT IN COGS.

John Fitzgerald recently brought an action by Elizabeth Fitzgerald, his guardian, against the Elsas Paper Company, to recover damages for a personal injury sustained by him while employed by the defendant.

It appeared that while Fitzgerald, who was a boy of sixteen years of age, was feeding a cylinder press, he slipped from a platform upon which he was standing, and the knee of his trousers was caught by a cog wheel, and his leg injured. The action was brought in the Municipal Court of the City of New York, and in this Court judgment was rendered for the plaintiff. The defendant appealed to the Appellate Term, where the judgment was reversed.

It did not appear whether or not the wheel was guarded, according to the requirements of the Factory Act, but the Appellate Court held that the plaintiff was of discretionary age and had worked at the press in question sufficiently long to be charged with knowledge of obvious perils, and so must be held to have waived the protection of the act by accepting the employment and working and continuing to work upon such a machine. (96 N. Y. St. R., 597.)

Small Stern-Wheelers for Siberia.

The Fulton Engineering and Shipbuilding Works has just completed two of the greatest curios in marine architecture ever seen on the Bay of San Francisco. They are stern-wheel launches, each of which is 35 feet long, with a 12-foot beam and only 24 inches depth of hold. Loaded they only draw 6 inches of water, and under trial have made 7 knots an hour. The little river boats are perfect in every detail and would delight the heart of a curiosity hunter. The engines are marvels of lightness, compactness and strength. A 'longshoreman could easily pick up one of the machines and carry it away.

The two boats are intended for the Amoor River (Siberia) trade. They have been built to the order of a Russian firm, and will go from here to Vladivostok on the tramp steamer "Leander."—San Francisco Call.

The moving of the St. Louis works of the Chicago Pneumatic Tool Company from St. Louis to Detroit is causing quite a stir in Detroit, as there are absolutely no vacant houses suitable for the habitation of workingmen, and where the employees who accompany this factory will be housed is a problem that the landholders and real estate men are trying to solve. The site of the new location is at the corner of Second avenue and Amsterdam street. The employees will be brought to Detroit by special trains, and a plan to meet them with a brass band and have a parade is being discussed by Detroiters, but it is rather doubtful where to take the procession, unless the house builders of Detroit push things between now and June.

The Southern Railway Company has sent us a copy of a volume, edited by Frank Presbrey and published by it, entitled "The Empire of the South." It is filled with information, descriptive and statistical, regarding the resources, industries and resorts of the different parts of the South, and is illustrated with nearly 500 attractive views. Manufacturers who are seeking a desirable Southern location will doubtless find this book of use to them. It can be obtained for 15 cents by addressing the Eastern passenger agent of the company, at 271 Broadway, New York.

At the January meeting of the Central Railway Club in Buffalo, N. Y., a paper on "Lubrication of Freight and Passenger Equipment Cars" was read by H. C. McCarthy. Owing to the demand for pamphlet copies, an extra number have been printed. They can be obtained at 12 cents each from the secretary-treasurer, Harry D. Vought, 114 Fifth avenue, New York.

The New York business of the Crescent Steel Company in furnishing blanks for milling cutters has developed to such proportions that it has become necessary to issue a list giving the sizes of such blanks that are kept in stock here. This is furnished for the convenience of customers.

The annual convention of the Master Car Builders' Association will be held at Saratoga Springs, N. Y., June 18 to 20, and that of the American Railway Master Mechanics' Association at the same place, June 21 to 23.

New Catalogs.

The Baldwin Cycle Chain Company, Worcester, Mass., sends a pamphlet illustrative and descriptive of detachable automatic automobile chains. The company has had years of experience with bicycle chains and is now developing heavier ones of many sizes and patterns for automobile work. This pamphlet is 7x5 inches.

We have received a pamphlet descriptive of the Sims hydraulic engine, made by the Sims Hydraulic Engine Company, Lincoln, Neb. This is a simple reversible machine consisting of a motor proper and controlling valve, foot-switch bracket and engine head, and intended for dental work. Size of pamphlet, 5¾x7½ inches.

We have received a catalog of Austin separators for live and exhaust steam, manufactured by the Austin Separator Company, 59 Woodbridge street, Detroit, Mich. Steam separators of several patterns are shown, also oil and ammonia separators and Austin's patent spraying device. The pamphlet is of standard size, 6x9 inches.

The Deming Company, Salem, O., sends us a 5x6¾-inch catalog of iron and brass pumps, hydraulic rams, well tools and supplies, etc.; two catalogs, 5½x7¾ and 6¼x3½ inches, of pumping machinery, including triplex power pumps, electric and otherwise, deep-well pumping engines, etc.; a catalog, 5x7½ inches, of spray pumps and nozzles.

The Commercial Electric Company, Indianapolis, Ind., sends copies of its bulletins Nos. 1110 and 1114. The former is devoted to slow and moderate speed multipolar motors and generators, and the latter to iron-clad, type "R," moderate and slow-speed motors, with some data of iron-clad type "R" generators. Size of page, 8¾x6 inches.

The Buffalo Dental Manufacturing Company, 587-589 Main street, Buffalo, N. Y., sends its 1900 catalog of brazing stands, blowpipes, tool forges, foot blowers and gas burners. These are not limited to the purposes which the name of the company might imply, but are intended for general workshop and tool-room purposes. Size, standard, 6x9 inches.

"A Book of Sprocket Chain Appliances" is issued by the Webster Manufacturing Company, Chicago. This is a catalog of conveying machinery in its elementary and assembled states. The subject branches out as far as helical (so-called "spiral") conveyors, friction clutches and manila-rope transmission sheaves. The size of this catalog is 4¾x6½ inches.

Schwerdtle & Siebert, 35 Fairfield avenue, Bridgeport, Conn., have for distribution their Catalog "A" of steel, brass and rubber stamps, stamp supplies, seal presses, burning brands, badges, checks, etc. The firm announce that in addition to their regular lines, they make a specialty of factory work, sink dies, letter and ornament castings, design brass molds, etc. The pamphlet is 6x4 inches.